Dan M. Braun

INSECT PEST CONTROL MANUAL

FOR

THE SOUTHERN APPALACHIAN REGION

UNITED STATES DEPARTMENT OF AGRICULTURE
U. S. BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE
Harrisonburg, Virginia

BLISTER RUST CONTROL MANUAL

F O R

THE SOUTHERN APPALACHIAN REGION

I N D E X

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JUNE 1946

FOREWARD

This manual has been prepared for the purpose of acquainting the field men with the basic principals of white pine blister rust control so that a definite pattern of uniformity may be attained throughout the region in methods relating to establishing base lines, surveys, white pine mapping, checking and ribes eradication.

Part I of this manual is devoted to general information on white pine blister rust control. Part II on grid control survey, Part III on mapping and checking and Part IV on ribes eradication.

It is not to be expected that this manual will give the answers to all blister rust problems. No manual can do that. It is mainly to serve as a tool and an aid in training new employees and helping to correct some of the faults or misunderstandings of older employees. Certain problems must be met in the field as they arise.

PART I

GENERAL INFORMATION

I N D E X

PART I

GENERAL INFORMATION

INTRODUCTION

All men who are employed on blister rust control should have a general knowledge of what blister rust is, where it is found, what it looks like, how it acts, how it spreads and the damage it can cause. They should thoroughly understand the job they are assigned to do and to realize that their job is essential in the control of the blister rust disease. The more information they have concerning this job the greater their interest will be as well as in being able to intelligently answer questions asked by the general public.

WHITE PINE BLISTER RUST

What it is: White pine blister rust (Cronartium ribicola Fischer) is a fungus disease which attacks and kills white pines.

Where it is found: Blister rust is now found in all of the major white pine growing regions of the United States. First found in Europe in 1854 it was unknowingly introduced into the northeastern part of the United States about 1897 and into British Columbia about 1910. In the Southern Appalachian Region the rust has gradually been spreading southward and is now present in the States of Maryland, Delaware, Virginia, West Virginia, North Carolina and Tennessee.

The disease was first reported in the Southern Appalachian Region in 1911 by Spaulding in Clarke County, Virginia. It was found on planted white pine which was destroyed. The disease apparently became firmly established about 1922-24 in Pendleton County, West Virginia and Rockingham County, Virginia. Several infections were found on ribes (gooseberry and currant) in 1929-34 in this section of Virginia and West Virginia. The year 1935 was apparently favorable for the spread and it was found for the first time as far south as Lexington, Virginia and White Sulphur Springs, West Virginia. Some local spread was observed each year. During 1941 it was found for the first time on ribes in four other counties in West Virginia, ten in Virginia, two in northeastern Tennessee and four in northwestern North Carolina. It was found on pine south of Roanoke for the first time in 1942. Infection on ribes continued to appear around the junction of North Carolina, Tennessee and Virginia from1941-45. In the

Fall of 1945 an old infection on pine was found in Ashe County, North Carolina. This infection is believed to have originated about 1936. It is very likely that the disease will continue to spread southward as far as ribes and white pine are growing in association with each other. At the present (June 1946) it is found in all of the commercial white pine producing states in the United States except Georgia, Kentucky and South Carolina.

Since the Federal Quarantine Act was established in 1912 there has been strict control of the movements of ribes and white pine to prevent the establishment of the disease in non-affected white pine areas.

What it looks like: The rust can be observed both on the underside of ribes leaves and on the bark of infected white pine. In the late spring and early summer the rust on ribes leaves are observed as tiny reddish-brown pustules. In late summer and fall small reddish-brown hair like objects are noticed which give rise to spores which infect the white pine On white pines the disease is very evident in the early spring where infected branches and stems have developed fruiting cankers. These swollen and often spindle-shaped cankers are noticable by the presence of numerous grayish white papery sacs which are filled with masses of orange colored spores. When these sacs burst open the spores are distributed by the wind. Blister rust cankers on white pines are often located by the presence of "flags". Flags are caused by dead needles on infected branches and their reddish color stands out against the healthy green foliage.

[illegible] preserve many other characteristics which indicate the presence of the disease on white pines such as the dark brown or blackish pycnial scars on old cankers, bark discolorations, etc.

How it acts: Blister rust lives alternately on the white pines or five-needled pines and on ribes (currant and gooseberry) plants. It is carried between these host plants (Figure 1) by wind-borne spores. The spread from infected pines to ribes may exceed 300 miles, but it spreads from ribes to pines in damaging amounts for only short distances, usually not exceeding 1,000 feet. The fungus cannot spread directly from pine to pine; it spreads from pine to ribes and from ribes back to pine, thus making a complete life cycle. On ribes it attacks the leaves and on pines the inner bark, where in time it causes the death of the tree by girdling.

Control of the disease is obtained by the eradication of all ribes growing in white pine stands and within a surrounding protective zone of about 1,000 feet. (Refer to Part IV - Ribes Eradication).

Damage to White Pine: If left unchecked the blister rust fungus can do great damage to fine stands of white pine. Where ribes and white pine

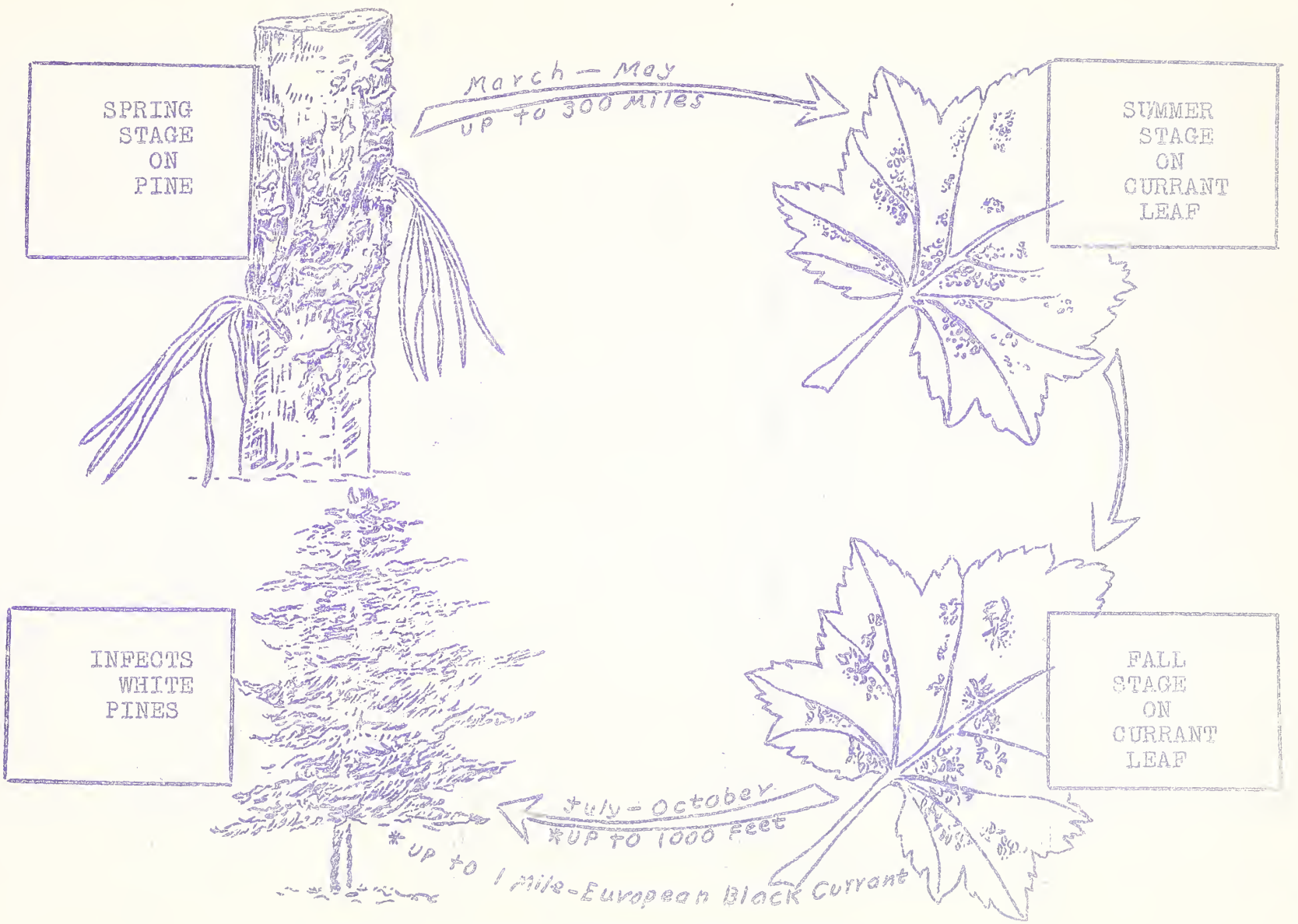


Figure I HOW BLISTER RUST SPREADS

are growing in association with each other the rust continues to build up from year to year until the entire stand is infected. Old trees may live on for many years but young reproduction is quickly wiped out. As long as the ribes are left to grow the stand will never have a chance of perpetuating itself. A healthy white pine stand can only be maintained by destroying all ribes within the control area.

RIBES FOUND GROWING IN THE SOUTHERN APPALACHIAN REGION

By wild ribes we mean those species of ribes which are found growing naturally throughout the region. Besides these so-called "wild" ribes we have cultivated ribes which are grown in gardens for their fruit or as ornamental shrubs. Although cultivated ribes offer somewhat of a problem in certain localities our greatest concern is with the wild species.

Ribes (gooseberries and currants) have several characteristics which identify them. Ribes are shrubs which vary in height from a few inches up to ten feet. All of the gooseberries and some of the currants have spines at the nodes, which are the joints of the stems, and often have numerous prickles between the nodes.

Ribes leaves are always alternate on the stem (Figure 2) while the leaves of many other plants, such as maple are opposite.

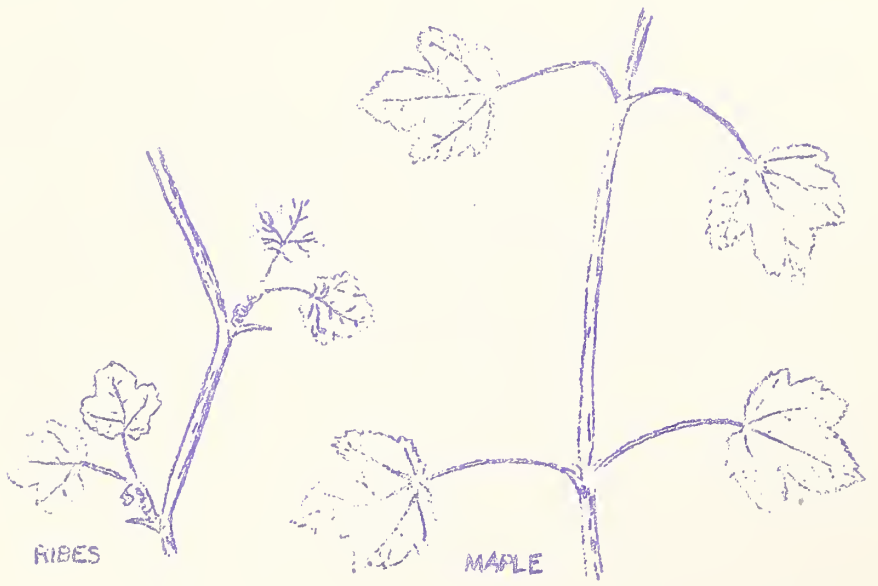


FIGURE 2 - Ribes Leaves are Alternate

The beginner on blister rust work will often mistake thimbleberry or ninebark with ribes. These two plants are characterised by leaf-like projections (stipules) at the base of the leaf stem. Ribes leaf stems do not have these stipules - (Figure 3).

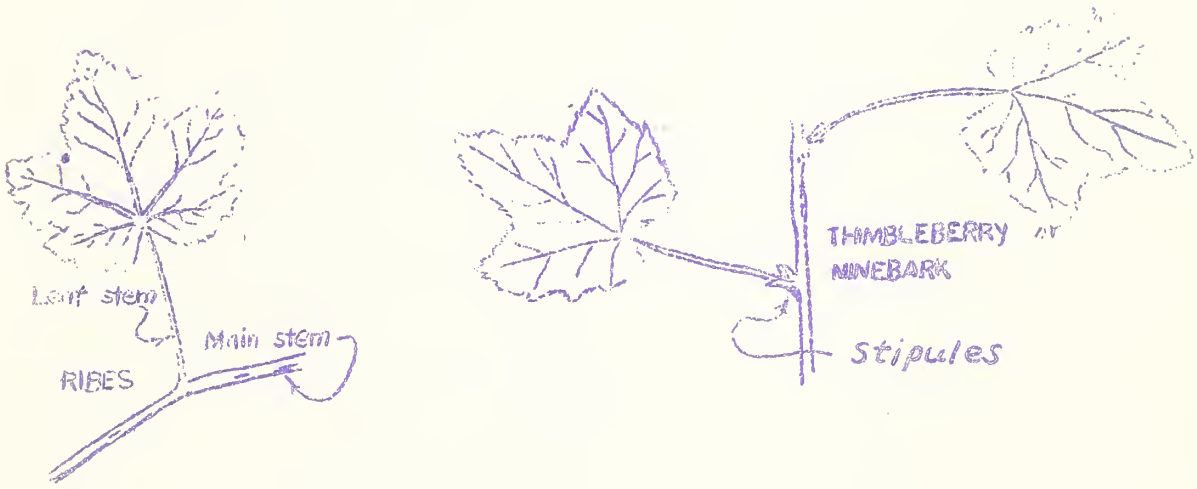


FIGURE 3 - Ribes do not have stipules at the base of the leaf.

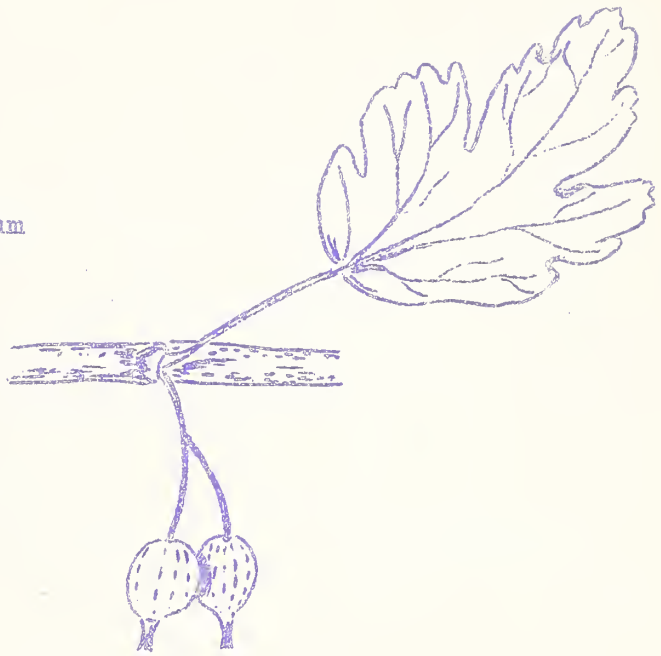
In the Southern Appalachian Region we have six recognized species of wild ribes. Of these six species two are of major importance, two of minor importance and two of practically no importance as far as the control of blister rust is concerned.

Following is a brief description of each species in the order of their importance.

R. rotundifolium (smooth or round leaf gooseberry). This species is found widly distributed at the higher elevations in Maryland, West Virginia, Virginia, Tennessee, North Carolina and occasionally in Georgia. In Georgia the lowest elevation at which they grow is approximately 4,500 feet. In Maryland they have been found at elevations of approximately 1,000 feet. There is proportional variation between these two extremes. They make their best growth on cool moist sites where shade is moderate to light.

FIGURE 4 -

Ribes rotundifolium



Leaves: Rounded at base, 3 lobed, petioles smooth without branched hairs.

Stems: Smooth but with nodal spines (single or in twos, very short, often wanting).

Flowers: Sepals greenish, slightly purplish at base, petals white.

Fruit: Smooth, yellow to purple 6-8 mm long.

Habitat: Common in rocky moist places and woods.

Distribution: New York, New Jersey, Pennsylvania, Maryland, Virginia, West Virginia, Tennessee, North Carolina and occasionally in Georgia. Also reported in Alpena County Michigan, at Thunder Bay.

R. cynosbati (prickly or pasture gooseberry). The range and growth of this species is much the same as R. rotundifolium except that it has a tendency to grow at elevations of 500 to 1,000 feet lower. In addition to being found in the Blue Ridge and Alleghany Ranges from Maryland to Georgia, it is also found in the Cumberland Mountains of Kentucky and Tennessee. It appears to produce more fruit and seed than does R. rotundifolium. It is regarded by some persons to be slightly more suseptible to the blister rust than is R. rotundifolium. It is seldom found at the extremely higher elevations north of Asheville, North Carolina.

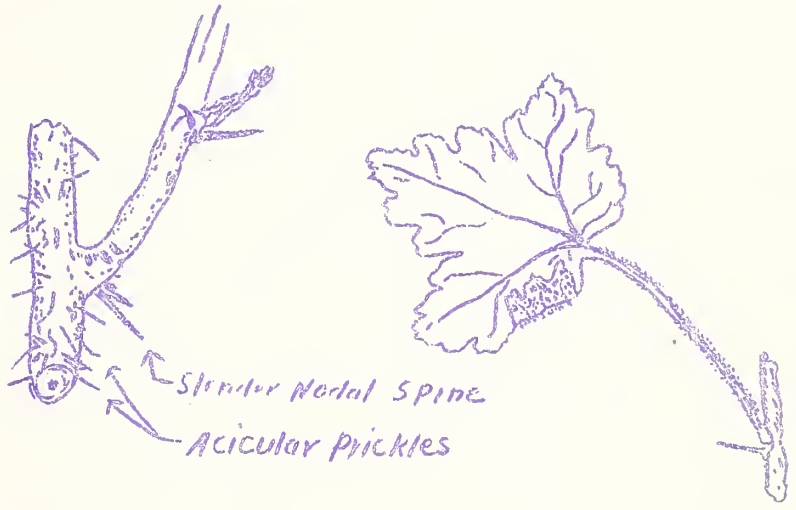


FIGURE 5 - Ribes Cynosbati

Leaves: 3 to 5 lobed, hairy above and below, rather thin, heart shaped or square at base.

Stems: Older branches with few prickles and slender nodal spines, fast growing, new shoots gray or brown, very prickly.

Flowers: Sepals green, petals white.

Fruit: Wine colored, armed with stout prickles, edible, 8-12 mm in diameter.

Habitat: Found in woods, rocky places and high upland pastures.

Distribution: New England States, New York, Pennsylvania, New Jersey, Michigan, Wisconsin, Minnesota, Maryland, Virginia, West Virginia, Tennessee, North Carolina, Georgia.

R. curvatum (Southern or Granit Gooseberry). This bush is very similar to the R. cynosbati except that the fruit does not have spines and the nodal spines on the stem are usually curved. It has been found growing wild only in Georgia and along the southern half of the Cumberland Mountain Range in Tennessee. Field tests have shown it to be about equally susceptible to the rust as R. rotundifolium and R. cynosbati.

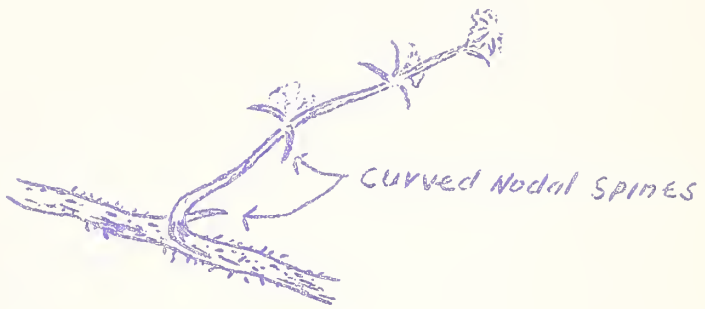


FIGURE 6 - Ribes Curvatum

Leaves: Three to five lobed, lobes short, roundish, sparingly hairy, dark green above paler green beneath; petioles slender and hairy, often shorter than blades.

Stems: Stem and branches smooth; slender, arching, much branched young shoots thin, smooth, shinny red brown without bristles. Old branches with prickling bark; nodal spines mostly solitary, 5-8 mm long and often curved, brown.

Flowers: Sepals white 6-7 mm long; petals very small 1-1.5 mm long, white pointed.

Fruit: Round, smooth, purplish, 6-8 mm across or sometimes larger

Habitat: Found in woods and granit outcroppings at elevations from 800 to 3,000 feet.

Distribution: Georgia, Alabama, Tennessee to Oklahoma and Texas.

R. glandulosum (Skunk Currant). Probably the fartherest south that this species has been reported is Clingmen's Dome on the North Carolina, Tennessee line some fifty miles north of the Georgia line. The elevation of this location is over 6,000 feet. The lowest known location in this general vicinity is on Mt. Sterling at about 4,900 feet. They are present at high elevations as far northward as Mt. Rogers, Virginia. In Gentry Creek, Tennessee, they were found in scattered areas at an elevation of about 2,500 feet. They have not been reported in any part of Virginia north of Mt. Rogers. In West Virginia they are present on Spruce Knob, Pendleton County at an elevation of over 4,500 feet. In Garrett County, Maryland, they have been reported as low as 2,400 feet along the Youghioughenny River and its tributaries. They have been found growing in association with white pine in only one place in North Carolina, one in Tennessee, one in Virginia and several in extreme western Maryland.

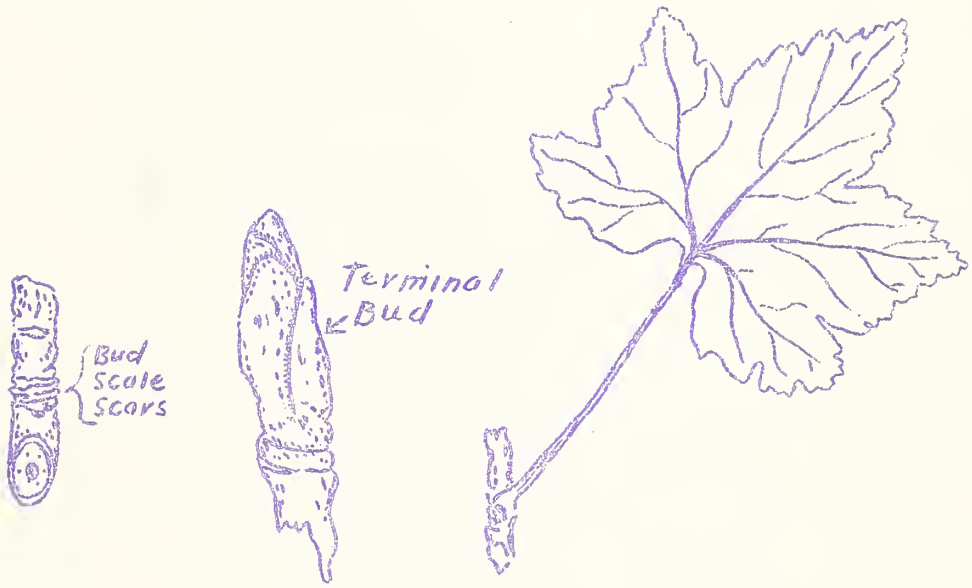


FIGURE 7 - Ribes Glandulosum

Leaves: Three to five lobed, leaves and stems with strong skunk-like odor when crushed, leaves hairy below, broader than long, petioles smooth.

Stems: Prostrate growth, rooting at nodes, shoots upright gray or brownish.

Flowers: Sepals white, often with a reddishtip or margins, hairy outside. Petals white or pink.

Fruit: Red, glandular bristly, insipid.

Habitat: Cool or cold moist locations.

Distribution: From the Rocky Mountains eastward through Canada to Labrador and Newfoundland and south to North Carolina.

R. lacustre (Prickly stemmed currant). This species has been reported on the Great Smoky Mountains National Park in the vicinity of Clingamen's Dome and Mt. LeConte. None are known to occur in the region in association with white pine. They may be present at other high elevations in North Carolina and possibly further north.

FIGURE 8 -- Ribes Lacustre

Leaves: Five to seven lobed, smooth, not broader than long, resembles R. cynosbati but more deeply lobed.

Stems: Reclined or erect, nodal spines in threes, internodal prickles numerous. New twigs reddish.

Flowers: Creamy white or pinkish outside, brownish crimson inside; sepals round, spreading; petals half as long, fan shaped.

Fruit: Round, black, covered with thin gland-tipped hairs; of pleasant taste.

Habitat: Cool woods and swamps.

Distribution: From Newfoundland to Alaska, and south to the mountains of Idaho, Colorado, Wyoming, Utah and California. Also reported at high elevations in the Great Smoky Mountains of North Carolina and Tennessee.

R. hirtellum (Smooth or wedge leaf gooseberry). This species has been reported from several locations of the Blue Ridge Mountains in Virginia. They are very similar to R. rotundifolium and in all probability many have been found and destroyed but regarded as R. rotundifolium.

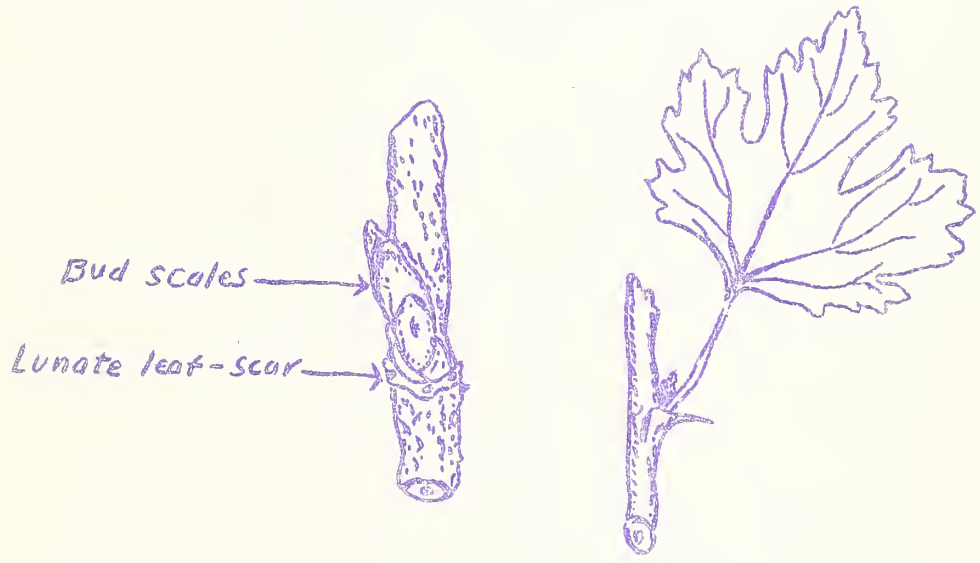


FIGURE 9 - Ribes Hirtellum

Leaves: Three to five lobed, smooth, rather thick, wedge shaped, leaf petioles usually with branched hairs.

Stems: Stem and branches slender, old branches dark brown, young shoots gray; nodal spines and prickles or bristles often wanting.

Flowers: Petals half as long, or shorter, as sepals, white or with pink nervation at base.

Fruit: Smooth, purplish or black.

Habitat: Prefers moist cool locations. Species often confounded with R. oxyacanthoides, R. inermis and R. rotundifolium. Has been widely used in producing new varieties of garden gooseberries.

Distribution: New England States, New York, Pennsylvania, New Jersey, Michigan, Wisconsin, Minnesota. Also reported by botanists in Maryland, Virginia and West Virginia.

All of the above mentioned species of Ribes except Skunk Currant are sufficiently similar that any one familiar with one species would very likely recognize any of the remaining five as a ribes bush. Wide variations are observed in all species. It is believed by many that hybrids frequently occur.

The following species are usually grown under cultivation but are frequently found at abandoned home sites or in some cases some may escape cultivation and, therefore, should be familiar to all field men.

R. sativum (Cultivated Red Currant). This species is known to most persons living in rural communities or small towns. There are many cultivated species of the cultivated red currant.

FIGURE 10 - Ribes Sativum

Leaves: Cordate at base, 3-5 lobed, lateral lobes spreading, smaller than middle one, smooth or with few scattered hairs above; paler below, petioles 4-5 mm long, channeled above.

Stems: High growing shoots, young branches with thin yellowish bark.

Flowers: Ten to twenty flowers to drooping raceme, rotate, greenish-yellow, sepals spreading, broader than long; petals very small, yellowish or reddish.

Fruit: Globular, shining and transparent, usually red, acidulous, 6-10 mm across.

Distribution: Cultivated throughout country. Does better in cool climates. Western Europe, North America. Often escapes from cultivation.

R. grossularia (Cultivated Gooseberry). The distribution of this species compares favorably with that of the cultivated red currant and is known to most persons.

FIGURE 11 - Ribes Grossularia

Leaves: Usually broader than long, roundish, 3-5 lobed, rather soft and thin, densely pabescent beneath.

Stems: Erect, stout grayish branches; nodal spines 1-3; growing shoots downy.

Flowers: Two to three flowers to raceme, sepals oblong tinged with red along margins and at base; petals half as long, white or faintly tinged with red, sometimes with a few hairs at the back.

Fruit: Roundish oval, dark red, purple or black. (R. resticum) purplish or black, R. hirtellum in some species or varieties greenish, purplish or yellowish.

Distribution: There are many species and varieties of the cultivated gooseberry all derived from the mother species R. reclinatum. In the eastern United States Grossularia hirtella(R. hirtellum) is the most common species, cultivated with varieties (such as Pale Red, Cluster, American Cluster and Ohio Prolific.)

R. odoratum (Yellow flowering currant, also known locally as Clove Bush, Spice Bush and in rare cases Black Currant or California Currant). This is an ornamental shrub which from a distance somewhat resembles Forsythia. They can be readily differentiated by careful observance even from a distance since the Forsythia blooms before the leaves are produced and the flowering currant blooms soon after the leaves are formed. The flowering currant begins blooming about one week after the forsythia has dropped its bloom. Occasionally it is difficult to convince owners that this bush is a ribes species that will carry the blister rust.

FIGURE 12 - Ribes Odoratum

Leaves: Thick and leathery, 3-5 lobed, lobes entire or toothed at ends, usually hairy.

Stems: Stems and branches smooth, erect, young branches pubescent older branches gray.

Flower: Bright yellow, fragrant.

Fruit: Globose or ovoid, 10 mm across or more, black or orange yellow.

Distribution: East of Rocky Mountains in the great plains from South Dakota to Texas, east to Minnesota and Arkansas. Much cultivated as a flowering shrub.

R. americanum (The American Black Currant or Wild Black Currant). This bush is occasionally grown under cultivation but escapes readily, particularly in moist sites. It is frequently found at old or abandoned home sites or nearby.

FIGURE 13 - Ribes Americanum

Leaves: Broader than long, resin dotted on both sides, thin, 3-5 lobed, ovid, sharply and coarsely toothed, bright green.

Stems: Smooth, branches angular old wood with gray or blackish bark.

Flower: 5-15 flowers to a raceme, greenish white or yellow.

Fruit: Black, smooth, roundish, similar in taste to that of R. nigrum

Distribution: New England States, New York, Pennsylvania, New Jersey, Michigan, Wisconsin, Minnesota, Also reported in Maryland, Virginia and West Virginia but are usually found growing under cultivation. Readily escapes cultivation.

R. nigrum (The European Black Currant). This species seldom found in the Southern Appalachian Region and no case is on record as its having escaped cultivation. It is mentioned here because it is extremely suseptible to the rust and produces sporidia in enormous numbers as compared to other wild and cultivated species. It is a favorite of immigrants from northern European countries.

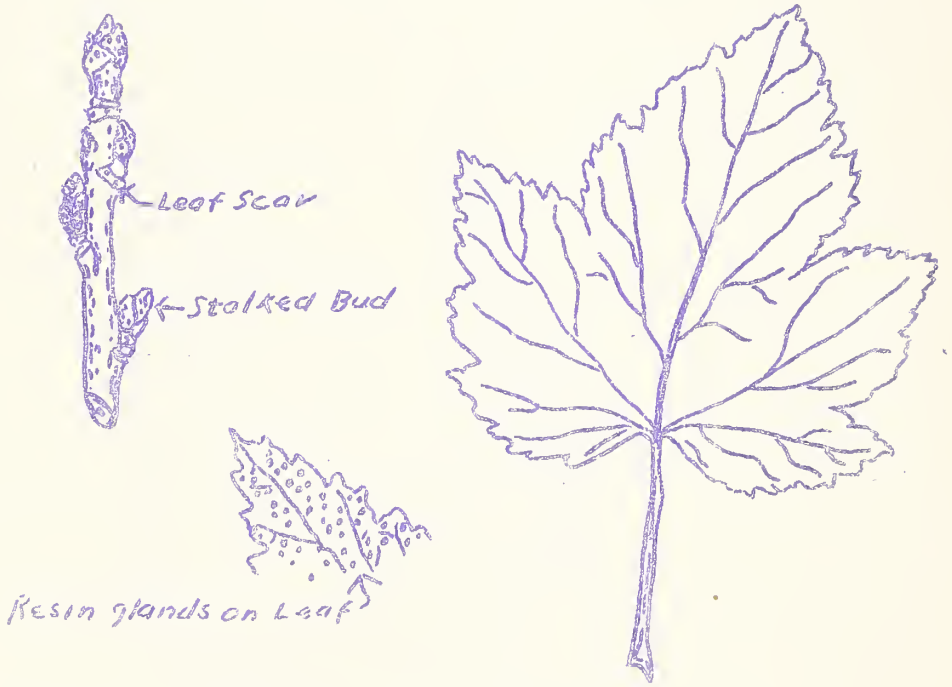


FIGURE 14 - Ribes Nigrum

Leaves: Large up to 10 c.m. long and 12 c.m. wide, 3-5 lobed, deep cordate base, numerous amber colored resinous dots on lower surface.

Stems: Upright, young shoots, pale, peculiar strong smell.

Flowers: Purplish, petals erect, whitish or reddish.

Fruits: Large, black, 8-10 mm across glandular with peculiar smell and tasts.

Distribution: Widely grown in Europe and North and Central Asia. Also in the northeastern United States and North Central States. Rarely found in the southeast.

WHITE PINE

Although there are a number of species of white pine found growing native in the United States there are only three which are of large economic importance.* These are Eastern White Pine (Pinus Strobus Linn.) which is the only white pine species found growing native in the eastern part of the United States, Western White Pine (Pinus Monticola Douglas) in the northwest and Sugar Pine (Pinus Lambertiana Douglas) in California and southern Oregon.

Pinus Strobus, or Eastern White Pine is found growing in the mountainous parts of the Southern Appalachian Region from the Mason-Dixon line to northern Georgia and northwestern South Carolina. It extends from the foothills east of the Blue Ridge Mountains westward through the Alleghanies and into the Cumberland Mountains of Kentucky and Tennessee.

Although pure stands of white pine are not uncommon in the region we find it for the most part mixed with hardwoods throughout more than one hundred counties in the States of Maryland, Virginia, West Virginia, Kentucky, North Carolina, Tennessee, Georgia and South Carolina.

White pine has many characteristics which make it a splendid timber tree. It is light in weight, strong, easily worked, and durable. Because of these qualities it usually commands top prices on the market and has sold as high as $21.00 per thousand board feet on the stump in certain sections of the region. White pine is used for pattern making, window frames and sash, shingles, interior trim, weather boarding, crating, matches and many other items.

* Although of no or little commercial importance but often of high aesthetic value there are in the western United States such species of white pine as Foxtail Pine (P. balfouriana Murray), Limber Pine (P. flexilis, James), Bristlecone Pine (P. aristata Engelmann) and the White Bark Pine (P. albicaulis Engelmann).

ADMINISTRATIVE ORGANIZATION

The Bureau of Entomology and Plant Quarantine of the United States Department of Agriculture is recognized as the coordinating agency for all blister rust control work in the Nation. The work on Federally owned lands is handled by the respective Federal agencies with the Bureau acting as Technical Advisor or in some cases the work is handled by the Bureau with the other Federal agencies reimbursing the Bureau for the work performed. Federal agencies cooperating in the work are the Department of Interior, which includes the National Park Service, Indian Service, and O & C Administration. In the Department of Agriculture, we cooperate with the Forest Service, Soil Conservation Service, A.A.A. and others. Pathological investigations are handled by the Bureau of Plant Industry in cooperation with our Bureau.

Our Division of the Bureau is designated as the Division of Plant Disease Control and handles white pine blister rust control work and black stem rust control. For administrative purposes on blister rust control we have five regions, namely, Southern Appalachian, Northeastern, Northcentral, Northwestern and Pacific. In addition, an office is maintained at Berkeley, California which devotes its time to the development of new control methods or improvements upon present methods. In the two western regions operation supervisors report directly to the regional office. In the Northcentral and Northeastern Regions all field work is under the supervision of a State Leader with the latter reporting to the regional office. Where there is only a limited amount of work some States are combined into one area with the work supervised by an Area Leader. The Southern Appalachian Region is divided into two areas with the field supervisors reporting directly to the Area Leaders who are headquartered in the regional office.

Work on State and private lands is carried on through cooperative agreements with the proper State officials which may be State Pathologists, State Entomologists or State Foresters.

The Southern Appalachian Blister Rust Control Region is made up of nine States; namely, Delaware, Maryland, Virginia, West Virginia, Kentucky, Tennessee, North Carolina, South Carolina and Georgia. (See page 19 for map of Area Organization).

Federally owned land falls in all of the above States except Delaware and Maryland. In Forest Service Region 7, with headquarters in Philadelphia, Pennsylvania, we have the George Washington, Jefferson, Monongahela and Cumberland National Forests. In Forest Service Region 8, with headquarters in Atlanta, Georgia, we have the Pisgah, Nantahala, Cherokee, Chattahoochee and Sumter National Forests. On National Park Service lands we operate on the Shenandoah National Park in Virginia, the Blue Ridge Parkway in Virginia and North Carolina and the Great Smoky Mountains National Park in North Carolina and Tennessee.

REGIONAL ORGANIZATION

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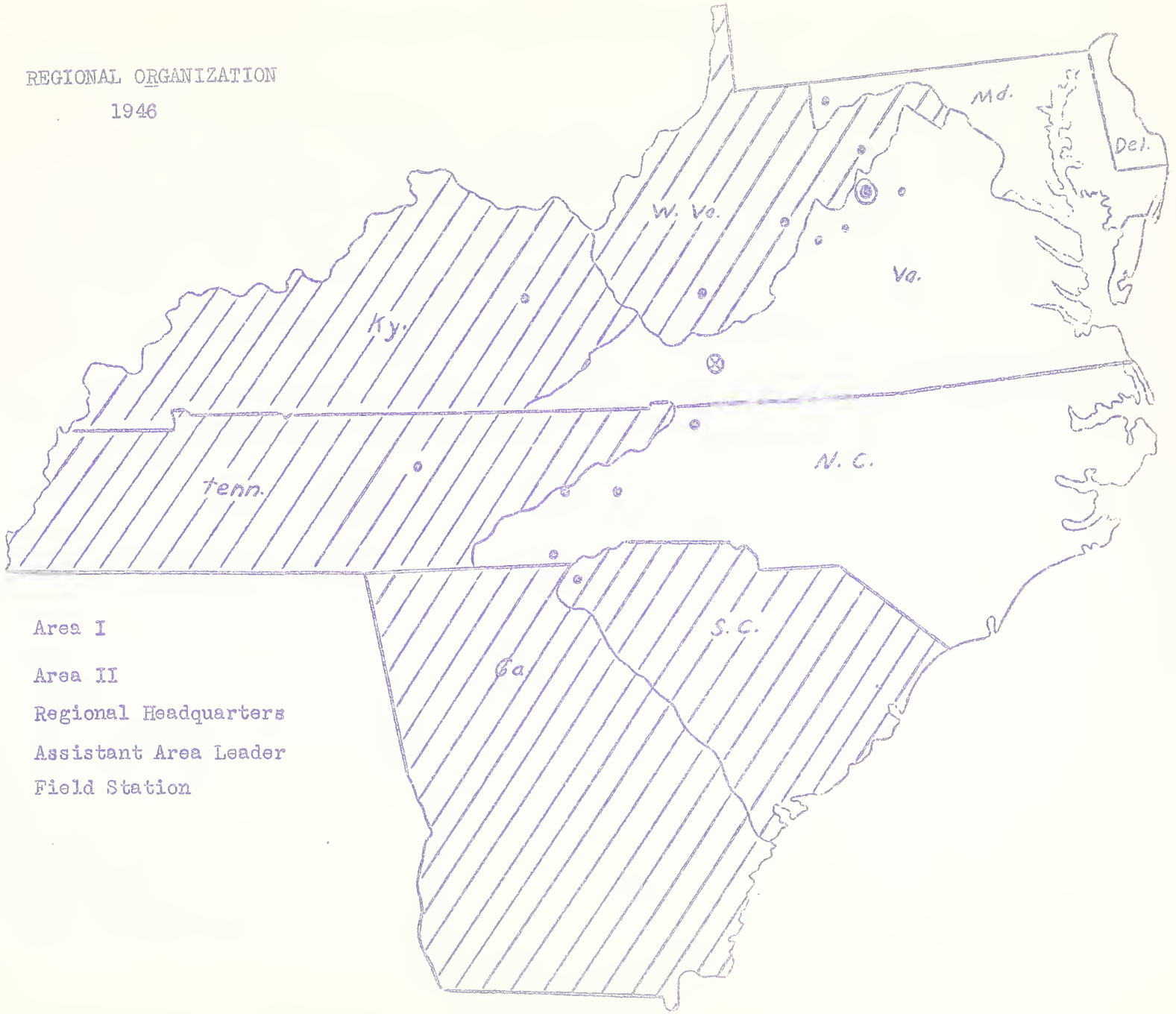

All other blister rust control work in the Region is performed on private and State lands.

Although most of us are on the Federal pay roll, it must be remembered that when working on privately owned lands we are acting as an agent of the State. All supervisors are, or should be, provided with credentials designating them as agents of the respective State law enforcement body. All laws pertaining to the entrance upon the property, distruction of the plants and intra-state movement of plants, are originated and enforced by the State. The only Federal laws applicable in the field pertaining to blister rust are those concerning the inter-state movement of plants. The inter-state movement of ribes and white pine is covered by Quarantine #63 of the U. S. Department of Agriculture, copies of which are available upon request.

The provisions of this quarantine are, briefly, as follows: The inter-state movement of white pine visibly infected with the blister rust are forbidden throughout the United States. Provisions are made for inter-state shipments of infected white pine under certain precautions and with a permit issued by the Division of Domestic Plant Quarantine of the Bureau. The inter-state movement of any white pine from an infected State into a non-infected State can be made only under permit. In order to secure such permit the pine must have been produced and grown from seed in a protected nursery. This quarantine is revised from time to time as field conditions change and the rust spreads from State to State. The inter-state movement of European Black Currant, R. nigrum is now forbidden except to several mid-central States which do not grow white pine. The inter-state movement of other species of Ribes is permissible under permit from the Division of Domestic Plant Quarantine. In most cases the Bureau designates the State Entomologist or State Plant Pathologist of the respective States as their agents for issuing such permits. Shipments are permitted without question into those parts of a pine producing State outside the blister rust control area and are refused when the shipments are destined to a point within the control area. The intra-state movement of both ribes and white pine is entirely in the hands of the State officials. You should be familiar with Federal Quarantine #63, as well as the quarantines in the States in which you are working. Any violation of any quarantine should be reported to the proper authorities giving all available facts for such action as they see fit to take. The blister rust Federal Quarantine Law has recently been revised as well as most of the State quarantine laws. Copies will be issued to all field supervisors as soon as our supply is received.

ACCIDENT PREVENTION

Accidents are generally regarded in two main classes, namely those involving personal injury and those involving automotive equipment. Every precaution should be taken to prevent accidents of either type. The most common of the first group are injuries resulting from falls in the woods or infections developed from minor scratches. Each man or group of men should be equipped with a First Aid kit at all times and a snake-bite outfit during the summer season. At least one man in each group should be thoroughly familiar with the use of the snake-bite outfit and should know the principles of first aid. The foreman should be constantly alert for careless practices on the part of the men and take every precaution to prevent accidents. However, in spite of all precautions some accidents will occur. In this case, the foreman should be familiar with not only the principles first aid but the regulations covering the treatment of injury cases. The men should be encouraged to report even minor scratches and have first aid treatment applied. A Safety Manual is being prepared and should be studied carefully by all employees, particularly foremen and crew leaders.

Accidents involving automotive equipment are usually the result of carelessness on the part of someone. It is the responsibility of our drivers to see that they not only drive in such a way that they are not at fault if an accident occurs but that they take every precaution to avoid an accident even though the fault would lie with someone else. Every driver should be familiar with the Accident Report Form, AD-250, and should see that a supply of these forms are in the truck at all times. They should also be familiar with the State Motor Vehicle Laws as well as the ordinances in cities and towns in which they are driving. The operating condition of each truck and automobile is primarily the responsibility of the driver. If, in his opinion, it is unsafe he should not drive it but report it immediately to his superior and he should take the necessary steps to have it placed in safe operating condition. The responsibility of the driver and their conduct in the event of an accident is covered by Bureau Memoranda, copies of these should be in each truck at all times and the drivers familiar with their contents.

Any questions regarding safety measures for either groups of accidents should be referred to your immediate supervisor and so on up the line until a satisfactory answer can be found.

PART II

GRID CONTROL, SURVEY

I N D E X

PART II

GRID CONTROL SURVEY

INTRODUCTION

We have now reached the point in our survey program where we are mainly concerned with the resurvey of white pine lands which were covered eight to ten years ago. We have found that many of our early pine area records and maps are now quite obsolete. The early survey was usually nothing more than a rapid reconnaissance with rough estimates being made as to acreage and densities of pine stands. In a few cases systematic surveys were run either from designated base lines or by compass traverse. Another good reason for making our white pine resurveys is because of the gradual increase in white pine acreage and densities during the last ten years.

On the following pages the system of establishing base control lines is explained and illustrated. All surveys are to be made using the square mile grid system. The grid (640 acres) is our work unit and since these grids will have to be reexamined from year to year it is imperative that our grid control system be as accurate as possible. A s.., our base lines should be so marked that any grid can be located without undue confusion.

Our work block is made up of 48 grids or 32,320 acres. All or a portion of a block may fall within a pine area.

MEASURES USED IN SURVEY, MAPPING AND CHECKING

Before an intelligent survey can be conducted, one must be familiar with certain standard measures used in establishing ground control:

1 Chain equals 66 feet, equals 100 links
5 chains equal 1 tally
80 chains equal 1 mile (5,280 feet)
10 square chains equal 1 acre
1/4 chain equals 16½ feet, equals 1 rod, equals 1 pole
40 chains of check strip (40 transects) equal 1 acre (strip acre)
1 chain transect equals .025 acres
1 grid equals 1 square mile, equals 640 acres
1° subtends an arc of 90 feet (or 144 links) in one mile.

HORIZONTAL CONTROL

Horizontal control means the system of establishing the relative position of portions of the earth's surface without respect to elevation. Our grid system, which is employed in the white pine region of the Southern Appalachians, provides the horizontal control, which is well adapted to designate areas, to describe their locations, to compute acreages, to locate and relocate the areas and to map and plot them. In general, it provides a well defined work unit in which the control is definitely established and fixed.

In using our grid system it must be remembered that there are certain deficiencies which have cropped up during the course of survey. For one thing, we have never established true base lines from which our grids were established. In some crews proper attention was not given to declination (the angle between magnetic and true north) which resulted in base lines being considerably off of true north. In other cases errors in slope readings occurred which resulted in short or long grids which were never corrected. Lack of care in making up base grid maps or the use of inaccurate maps often resulted in making many adjustments in the field, also because of the lack of trained surveyors we were obliged to allow a much greater error of closure than would be required on a regular Public Survey. However, regardless of obvious errors, we do have definite work area units established and by properly marking the location of grid corners and grid lines we will be able to reestablish these units without difficulty. In general, it must be said that the survey so far has been adequate and the interest our men have taken in doing their best to make proper closures is to be commended. After all, our purpose in making a rectangular survey is solely for our own use and was devised to bring out a more efficient method of establishing and maintaining ground control. This we have done and we have the advantage in this respect because we do not have to rely on old survey notes to relocate lost corners or property lines. We do, however, have to know the location of our own corners and survey lines, otherwise confusion will result when an attempt is made to reestablish control at a future date. Also, in order to maintain a fair degree of accuracy in our survey work we must make extensive use of established control points which may either be Bench Marks, Class "A" corners, triangulation points, etc.

The one important thing to remember, therefore, is that we should pay particular attention to establishing well defined horizontal control so that accurate base maps may be made and subsequent examinations of the same area will be made easier because such control is easily reestablished. This is especially true on lands which will be in need of reworking for some years to come. Normally our horizontal control has been run at the time of running our pine surveys. Although old pine area boundaries are considered in order to prorate past work on grid basis, all subsequent work will be performed using the grid as the basic unit of work. The only areas which will probably be retained will be on the Shenandoah National Park in Virginia. Even here, however, the basis for all survey, checking and ribes eradication will be the grid.

The marking of survey lines and compass [illegible] The use of flagging, cardboard location tags and metal location markers, should always be used in conjunction with horizontal [illegible] work.

Methods of chaining have varied greatly throughout the region. If we do not attempt to standardize our chaining methods we will be unable to rely on any degree of accuracy of the work performed. Experience has taught many of our men to be good chainmen and to date we have gone along very well. Nevertheless a certain degree of carelessness often creeps in and a man may be more prone to guess the degree of slope change than be bothered to use his Abney or Clinometer. Serious trouble can often result in this practice, especially where slope changes are abrupt. The handling of the chain itself is also very important. Carelessness in keeping the chain straight and taut before taking a reading, making incorrect slope readings from the trailer, roughly averaging abrupt slope changes on a two chain "shot," dropping or adding chain lengths, etc., all result in confusion and if not corrected will give us inaccurate grid control and erroneous maps.

Because our chaining is performed in 2-1/2 chain units it has been decided to adopt the 2-1/2 chain method of compass and tape survey.

THE 2-1/2 CHAIN METHOD OF COMPASS AND TAPE SURVEYS

(From manual of Compass and Tape Survey, By John N. Mitchell, Forester, Pacific Coast Blister Rust Control Region).

The Method in Outline

The method is based on progressing along the line being chained by intervals of 2-1/2 chains of horizontal distance. First, a slope distance of 2-1/2 chains is measured by the steel tape. (The 2-chain topographic tape is not graduated in chains or links beyond the 2-chain point, but it has a trailer about 35 feet long. A repair clip is placed on the trailer at a point 33 feet beyond the 2-chain mark. The result is a 2-1/2 chain tape.) Second, the slope is determined by an Abney hand level and the "advance" required for horizontal distance is obtained from a table and measured on the slope by the compass staff, which is graduated in feet for the purpose. For example, 2-1/2 chains is measured by the tape on a slope where the Abney reading is 20 topographic units; reference to the table shows that seven feet of advance are required on that slope to result in a horizontal distance of 2-1/2 chains. This is the basic method used by the Forest Service on timber surveys in the California region. Some modification of the basic method must be used if a good

exact results, but the error involved is insignificant and "compensating". Tenths should be based on horizontal distance; however, in most cases the error is of no importance if they are estimated roughly from slope distance.

By and large, only once in a hundred 2-1/2 chain shots does the slope change three times, but to show maximum use of tenths such a case is chosen for the example illustrated by Figure 1. Assume that the tape is stretched over a spur ridge so that it approximates the following; A topographic reading of + 40 for about 3/4 chain, +10 for about 1/2 chain, and -30 for the

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1/ Three ways of handling changing slopes, not recommended for common use follow: One procedure used where the slope makes a marked change is to take one or two chain shots, obtaining horizontal distance directly from the one or two chain trailer. Such a procedure has the disadvantages of not fitting the topography since the slope may change abruptly at points not close to one or two chains, and it requires more separate measurements, which takes extra time and introduces more possibility for mistakes.

A second but fundamentally incorrect practice is to "average" the slope readings. Averaging the readings of equal distances of slope and weighted averages of unequal distances results in a non-compensating error; the result is always less than 2-1/2 chains horizontal distance. Provided that the distances involved are about equal, slope readings which are not different by more than 10 topographic units may be averaged, and the error will not be significant.

A third method is to take any convenient slope distance and by the use of tables or graphs, convert it to horizontal distance. This method is avoided because it is slow and subject to mistakes of total distance.

remaining distance of about 1-1/2 chains. Such a slope would be considered as 3/10 of +40, 2/10 of +10 and 5/10 of -30. The signs of + or - have no significance in making an advance to obtain horizontal distance; they are used to show the nature of the topography and to help avoid misunderstanding when the Abneyman is calling the results of readings to the note recorder, as will be explained later. Referring to Table T-1 on page 13, it is seen that 2-1/2 chains measured on a topographic slope of 40 must have an advance of 28 feet added on that slope to give a slope approximate horizontal distance of 2-1/2 chains. Likewise it is observed from this table that the slope advances for 10 and 30 for 2-1/2 chains are approximately 2 and 16 feet respectively. To arrive at an estimate of the slope advance required for our broken-topography example above, we select from the table 8.4 as 3/10 of the advance for a slope of 40, .4 as 2/10 of the advance for a slope of 10 and 8.0 as 5/10 of the advance for a slope of 30. The total advance is 16.8 feet. Strictly the parts of this advance should be taken on its respective slopes, and some error is introduced when it is not so taken. (It makes no difference whether the advance is taken on an ascending or descending slope). Usually, however, a part of the advance is taken on a slope which is very nearly the proper one. Note that in this example it can be assumed that the advance will be taken on a slope of 30 if the slope near the end of this shot is at all constant, and, therefore, that the error is limited to that part of the advance involved in the slopes of 40 and 10. Since the objectives of our chaining do not require that it be precise, we are correct in using a procedure which expedites the work and still gives reasonable accuracy.

EXAMPLE OF STANDARD CHAINING METHOD

This example in narrative form and in considerable detail is to demonstrate the normal procedure in running lines in horizontal control. Observations, usually explanatory of the method, appear in parentheses. Simple and perhaps obvious details, although increasing the length of the example, are given with the object of making the standard procedure free from common sources of mistakes and of introducing devises, the use of which in the aggregate means far greater production.

FIGURE 1

Sketches illustrating the approximation of slope advance by the "tenth system" to permit chaining by 2-1/2 chain intervals of horizontal distance over a broken slope.

Basis: A table (Table T-1) showing for a horizontal base of given length the advance required to be added on a slope to a slope measurement of that given length so that the total slope line will have the horizontal equivalent of the base.

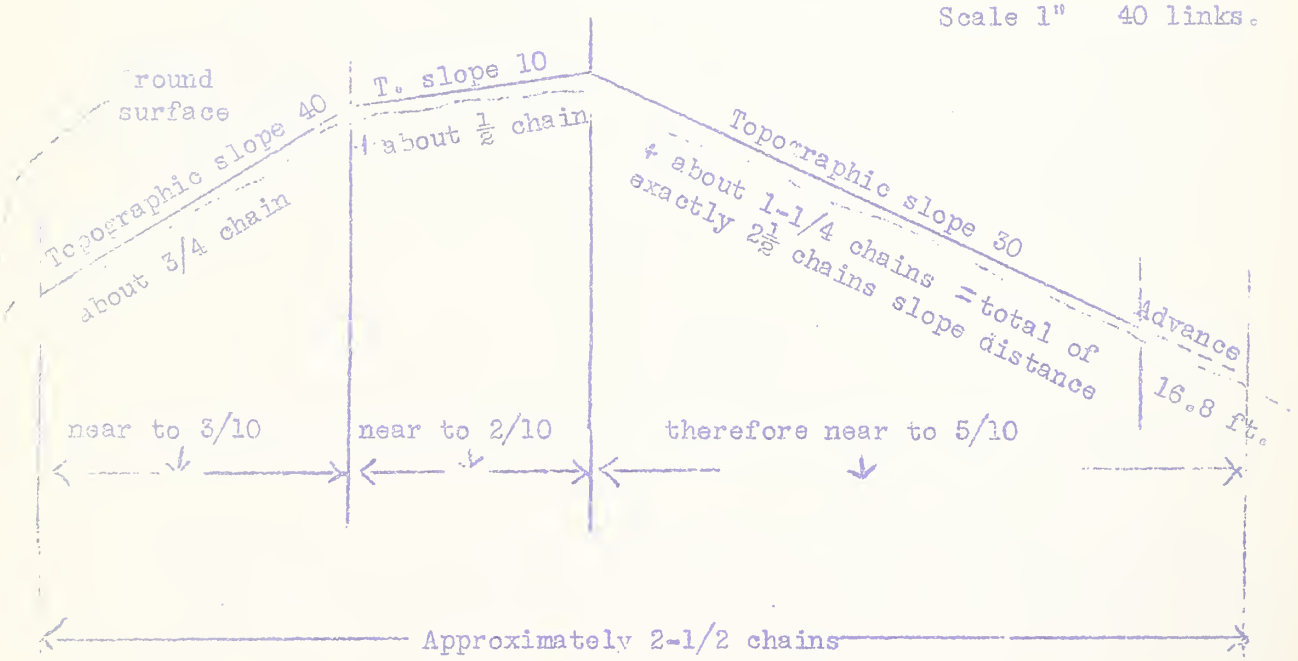
Length of base either 1/10, 2/10, 3/10,... 9/10, or 10/10 of 2-1/2 chains

A "tenth" is 1/4 of a chain or 25 links, .2 is 1/2 chain, or 50 links, .3 is 3/4 chain or 75 links, etc.

Tenths in practice are only estimates, but total exactly 10/10, or 2-1/2 chains.

Note: The "tenth system" results in only a close approximate horizontal distance of 2-1/2 chains because, first, tenths are estimated from slope distance and not horizontal distance, and, second, the advances are not always taken on the proper slope.

Example From Text



The control crew in this particular instance is composed of two men trained in the procedure. The division of labor for any crew is about the same; some variations are made at times to attain the greatest efficiency. The duties are so divided that both members of a crew are constantly at work without one waiting for the other. Here we have the checker keeping notes, running the compass, and acting as head-chainman; he has his assistant act as rear-chainman, take Abney readings, and put up cardboard location tags.

Assume the control crew, in starting the day, are just arriving at the corner common to grids A-11, A-12, B-11 and B-12, which has been previously well posted. The compassman, on reaching the corner first sets up his compass so that the needle will have settled by the time he is ready to use it; he then completes the heading of the control form. (It is suggested that the reader fold out the specimen data sheet, page 13 so that it may be referred to with ease as he reads). In the meantime the assistant, hereafter called the rear-chainman, has taken eight checker's cardboard tags previously strung and makes out one for each location at cumulative 2-1/2 chain intervals along the proposed course.

The sketches below, 1/2 actual size, indicate the data which are put on the reverse side of the checker's tags.

Figure 2

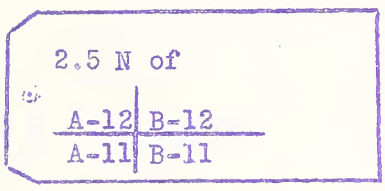


Figure 3

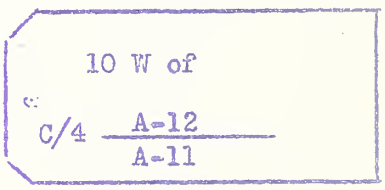


Figure 2 represents the first tag for use in the present example. Figure 3 is not related to the example, but is to illustrate a tag for a position 10 chains west of the quarter grid corner common to grids A-11 and A-12. Note that the minimum of lettering is used to save time in making out the 60 to 100 tags which are ordinarily used in a day. The information, however, is complete enough for the use of all blister rust control personnel and will be very useful during the current season. Experience has shown that if work is done in the grid the following season, for example, initial eradication and regular checking the year after the advance check, enough tags can be found to reestablish the points at the same time that the string line is reestablished. Therefore, the lettering should be done distinctly with an indelible pencil.

Both men count the eight tally rags and each makes certain he has no extra ones which might confuse the count. The compassman puts the eight tally rags deep in his pocket (not slipped through a belt loop in his pants or hanging partly out of a pocket where one may pull out in the brush and confuse the distance chained). The eight tags are put in sequence and placed in a shirt pocket. The compassman sets his compass for the desired bearing, and takes a final check to be sure the needle

is true and the bearing is the correct one. He carries the most distant foresight which is distinctive, taking note of its surroundings and remembering what kind of mark will be on the approaches it. He obtains if possible, one or more sights for use as intermediate points. If the distant sight line over a quarter of a mile away, he calls it to the attention of the rear-chainman so that they may verify it any time to be certain that the proper line is being projected. If possible a distinctive backsight is taken for the purpose of verifying the alignment should doubt arise later. Meanwhile the rear-chainman has untied the tape. He hands the head of the tape to the compassman, who sets out. The rear-chainman pays out the tape, keeping a firm grasp on the coiled portion (if held loosely it may snarl and cause great loss of time). Just before the end of the tape is reached the rear-chainman calls out "Cha-a-ain," which is the signal to the compassman to halt and prepare to stick. Without delay the rear-chainman grasps the 2-1/2 chain point of the tape, "plumbs" himself over the corner and calls "Stick." Hearing the signal the compassman pulls the slack out of the tape and gradually but quickly increases the tension until a strong pull is attained, which will overcome sag and tend to straighten the tape in undergrowth; using his staff as a plumb suspended at the zero mark on the chain he "sticks" it and calls out "Stuck," as the signal that the rear-chainman may release the tape.

Let us assume that the rear-chainman cannot see the compassman because of brush in the line of sight. At once the rear-chainman calls "Yoh! - Yoh!" to signal the compassman that he cannot see him. The compassman returns the signal "Yoh" and waves his arms so that the rear-chainman may locate him by the sound, or the motion, or the combination of the two. The compassman continues to call "Yoh" (until the rear-chainman gives the signal that he has seen him) and now attempts to reflect a flash of sunlight to the rear-chainman by means of the surface of his tatum. The rear-chainman sees this light, calls "O-Kay", and sights a twig in line with the light. He now takes an Abney reading on the twig. While the Abney reading is being taken the compassman is either setting up the compass, 1/ or in case no sight is necessary, he gets the proper "2-1/2" tag, a tally rag, and the note sheet ready. The rear-chainman calls "Minus seventeen." The compassman repeats "Minus seventeen" to verify that he heard correctly and makes the entry in his tatum which he has now open in readiness. The compassman inspects the table of advances (see table T-1, page 15) and records the appropriate advance of six feet. The recording is habitually done immediately after the reading is received, even if the slope requires no advance. This is necessary to avoid a mistake in total distance caused by intending to defer the recording until the next shot and then forgetting to do it. From the point where he "stuck" the compassman measures six feet

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1/ Note that compassman may need another compass sight before he leaves the present 2-1/2 chain locality. If so, provided that a foresight from this position is not impracticable because of brush, he should set the compass on the staff where he sticks so that the needle may settle while he makes notes. Were he to do his recording before setting up the compass, he might have to waste time simply waiting while the needle settled. Of course in case the signal "yoh" should come immediately after his signals "Stuck," his first consideration is to assist the rear-chainman in getting the Abney reading, for the rear-chainman cannot proceed until he makes the reading.

on the slope with the compass staff, which is graduated for the purpose. At this new point, which is 2-1/2 chains horizontally from the corner, the compassman makes a mark with the sole of his boot at right angles to the course of the line and lays a tally rag and the 2-1/2 chain tag in the mark.

Meanwhile, the rear-chainman has had the opportunity to gain some distance before the compassman starts. Ordinarily by the time the compassman has progressed to the vicinity of the point for the next stick the rear-chainman will have arrived at the last mark. 1/ The rear chainman now picks up the 2-1/2 chain tag and hangs it about eye-height on the nearest tree branch or bush. 2/ He also picks up the tally rag and puts it deep in his pocket, at the same time placing one foot on the mark in such a manner that he is facing a direction perpendicular to the chained line and with his other foot in the direction of the compassman. As before, he halts the movement of the passing tape as the end approaches him by calling "Chain." Quickly he locates the 2-1/2 chain mark on the tape by touch and holds it firmly against his body about waist high directly over his foot on the mark, and with his weight on this leg calls "Stick." His weight on the leg over the mark plumbs the 2-1/2 chain point of the tape over the mark, and when the pull comes on the tape his other leg braces his body so that the 2-1/2 chain point of the tape is not pulled off its position. Again the compassman, holding the tape waist high, eases the tape taut with a strong pull, plumbs with the staff at the zero point on the tape, and lets the point of the staff stick in the ground as he calls "Stuck." 3/ When the crew has become proficient the time required in sticking will be short, either man seldom having to wait for the other.

Let us assume that the compassman in progressing from the 2-1/2 chain mark to where he now sticks for five chains has noticed that the slope broke to a more sharp descent. Therefore, immediately on sticking he calls out "Double shot." This signals to the rear-chainman that he should string on up the line without delay to a point where he can see the compassman or his flash of reflected light, and where he calls

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1/ If the rear-chainman should be delayed so that the trailing end of the tape passes him he calls "Hold it," to signal the compassman to wait for him.

2/ Since the distance is chained from the actual mark and the purpose of the tag is to assist checkers and others, the tag need not be hund directly over the mark.

3/ Note that both men hold the tape waist high in sticking so that it will pull up free of the most brush possible and clear it from minor unevennesses of the ground. To hold it higher might clear more brush but introduce difficulty in plumbing over the marks with the proper pull on the tape.

"O-Kay." In this instance the rear-chainman sees the flash and "freezes" as he notes a twig in the line of the flash. 1/ The rear-chainman reads and reports the reading to the compassman as "Minus thirty-seven." 2/ The compassman records in the reading column: | -37 |. (See specimen chaining data sheet.) The rear-chainman has glanced at the slack tape where it rests and reports the reading of the nearest link "One hundred thirty-nine." Compassman notes: | 6-37 |, meaning that he estimated 139 links as being near to six out of ten parts of the 250 link interval of horizontal distance sought, and he inspects the table for this part of the advance, estimating that it is 14.5 feet. Meanwhile the rear-chainman has taken a reading back to the last location tag and reports "Minus twenty-one." The compassman notes; | 4-21, 6-37 |, knowing that if six of the ten parts are -37, then -21 must be for four parts. From the table he estimates the advance for 4-21 as 3.0 feet. Then he records the total advance of 17.5 feet in the proper column of the note sheet and measures it off on the ground.

Let us assume that the 20 chain mark has been reached. Now all eight tally rags have been used by the compassman. The rear-chainman removes the rags from his pocket, counting seven and adding the one on the ground at the 20 chain point, to make eight. The compassman also counts the eight rags and returns them to his pocket. While the rear-chainman makes out eight location tags for the next 20 chains, the compassman is preparing a location marker to be placed near this 20 chain point. An oak on line in the open near this point is selected as a good tree for the marker. The tree is found to be 34 links short of the 20-chain point. The marker will bear the statement "19.66 chs. S. to GC." (See facsimile of this marker on page 31.) 3/

1/ At the signal "O-Kay" the compassman may go about his duties, such as sketching a gulch on his map, and he does not have to stand by flashing and losing time while the rear-chainman takes the Abney shot. On the contrary, the instant the rear-chainman picks up the flash he shouts "O-Kay" to free the compassman, simultaneously observing a twig on which to direct his Abney shot, and he has stopped all movement of his body and eyes, except his hands which operate the Abney. The latter cessation of movement referred to as "freezing" is necessary so that the twig is close to the observer the angle measured will not be changed through his head being raised or lowered.

2/ Obviously the compassman knows this reading is minus and that the sign makes no difference in the advance. The compassman records the readings as plus or minus simply to show the form of the topography. The rear-chainman is required to preface his call of the reading by "plus" or "minus" to focus the attention of the compassman to the actual reading to follow.

MANDATORY PROCEDURE TO PREVENT THE TAPE-LENGTH MISTAKE

Using reasonable care, the error in chaining by the 2-1/2 chain method is unimportant. Experience, however, has shown that the really serious fault in chaining can be the mistake of dropping, or less frequently of erroneously adding a full tape length to the total distance measured. To eliminate the possibility of a tape-length mistake the following procedure will be used without exception:

1. Chainmen will take exactly eight tally rags to the field, and the common loss of tally rags will not be tolerated. The head-chainman will place a rag to mark each 2-1/2 chain point, the rear-chainman will collect these rags, and both men will check the number of rags against the record of distance at the beginning and the end of each 2' chains of line, or at the end of a line if less than 20 chains long.

2. The recorder will make his notes immediately after the establishment of each 2-1/2 chain point. Under no circumstances will he write in distances ahead of their establishment or defer the making of an entry.

3. Before the start of a 20-chain unit of line to be run, the eight location tags will be prepared, checked, and placed in order segregated from all other tags. The head-chainman will place the proper tag at each 2-1/2 chain point, and the rear-chainman will verify that each tag is placed and that it bears the proper notation as to total distance. There will be no exception to the placing of location tags at each 2-1/2 chain point on all lines chained.

Should any doubt arise as to the total distance during or at the end of any 20-chain interval, the total distance will be positively ascertained before proceeding. For example: assume a disagreement is found between the notes, the number of location tags, and the rag count. Unless the reason for the disagreement can be accounted for without any doubt, the crew will return over the line until the total distance can be positively established.

3/ Although there is only about an even chance that the true distance is within 10 links of 19.66, it is not considered good practice to mark the marker either 19-1/2 or 20 chains, since the probability is that the marker is closer to 19.66 than to either 19.50 or 20.00 chains. Futhermore, it is understood that distance on a marker given in links has been carefully, albeit not precisely, determined, whereas, a marker marked to the nearest 1/2 chain or chain indicates that the method by which it was placed is very approximate.

USE OF EXISTING RECORDS

Maps and other records are ordinarily available to assist in establishing adequate horizontal control for areas in blister rust control unit. The usual sources of records which are helpful, with comments as to availability and use, will be outlined.

Quadrangle maps of the Topographic Branch of the U. S. Geological Survey are usually too small a scale for any but extensive planning. They should not be overlooked, however, as a source of information not found on larger scale maps.

Administrative maps of the National Forests and National Parks are ordinarily useful in extensive planning and are thoroughly familiar to field personnel.

Forest Service timber survey maps, which are available for much of the area in control units, are of large scale and usually show recent culture, found survey corners, and the exact location of Class "A" corners.

Engineering maps of timber operators, power companies, and other private enterprises are generally a source of information similar to Forest Service timber survey maps, and are usually available through the Forest Service or occasionally are accessible by contacting officials in the concerns having prepared them.

Certain engineering maps and notes of the National Park Service contain information in the scope of horizontal control.

AN EXAMPLE OF CHAINING IN CLIFFS

Let us assume that while chaining a line the compassman shortly after the 30 chain mark comes to the edge of a cliffy formation 1/ extending for several chains. (see Figure 4, page 14.) He selects a convenient point on the edge of the cliff and calls for the rear-chainman to take a reading on the tape and a slope reading. These are 142 links and -24. The compassman refers to table T-6, page 43 where by inspection he sees that he should subtract 9 links to get the horizontal distance, and makes the record as shown on the specimen data sheet, page 13. The compassman now secures the staff to the thong on the head of the tape, and while the rear-chainman lowers this to the ledge below, the compassman finds a route nearby where he may work his way down to the ledge by an easier approach. He finds the slope too steep for any measured slope distance except the full 2-1/2 chains. The 2-1/2 chain slope distance is measured and the Abney reading

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1/ It should be planned so that, if possible, difficult lines such as those through heavy brush or across precipitous slopes may be chained down grade.

TABLE No. 1

PAGE 1

TABLE FOR OBTAINING HORIZONTAL DISTANCE BY ABNEY

Values in body of table are ADVANCES to be taken on Abney to give horizontal distance

Slope in TOPOGRAPHIC Units	Horizontal distance sought on the slope: 2 1/2 Chains* 10/10		1/2 Chain 2/10	3/4 Chain 3/10	1 Chain 4/10	1 1/4 Chains 5/10	1 1/2 Chains 6/10	1 3/4 Chains 7/10	2 Chains 8/10	2 1/4 Chains 9/10
	Ft.= Links		Advance in Feet							
5	1/2	1	.1	.15	.2	.25	.3	.35	.4	.45
7.5	1	2	.2	.3	.4	.5	.6	.7	.8	.9
10	2	3	.4	.6	.8	1.0	1.2	1.4	1.6	1.8
12.5	3	5	.6	.9	1.2	1.5	1.8	2.1	2.4	2.7
15	4	6	.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6
17.5	6	9	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4
20	7	11	1.4	2.1	2.8	3.5	4.2	4.9	5.6	6.3
22.5	9	14	1.8	2.7	3.6	4.5	5.4	6.3	7.2	8.1
25	11	17	2.2	3.3	4.4	5.5	6.6	7.7	8.8	9.9
27.5	14	21	2.8	4.2	5.6	7.0	8.4	9.8	11.2	12.6
30	16	24	3.2	4.8	6.4	8.0	9.6	11.2	12.8	14.4
32.5	19	29	3.8	5.7	7.6	9.5	11.4	13.3	15.2	17.1
35	22	33	4.4	6.6	8.8	11.0	13.2	15.4	17.6	19.8
37.5	25	38	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5
40	28	42	5.6	8.4	11.2	14.0	16.8	19.6	22.4	25.2
42.5	31	47	6.2	9.3	12.4	15.5	18.6	21.7	24.8	27.9
45	35	53	7.0	10.5	14.0	17.5	21.0	24.5	28.0	31.5
47.5	38	58	7.6	11.4	15.2	19.0	22.8	26.6	30.4	34.2
50	42	64	8.4	12.6	16.8	21.0	25.2	29.4	33.6	37.8
52.5	46	70	9.2	13.8	18.4	23.0	27.6	32.2	36.8	41.4
55	50	75	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0
57.5	54	82	10.8	16.2	21.6	27.0	32.4	37.8	43.2	48.6
60	58	88	11.6	17.4	23.2	29.0	34.8	40.6	46.4	52.2
62.5	62	94	12.4	18.6	24.8	31.0	37.2	43.4	49.6	55.8
65	67	101	13.4	20.1	26.8	33.5	40.2	46.9	53.6	60.3
67.5	71	108	14.2	21.3	28.4	35.5	42.6	49.7	56.8	63.9
70	76	114	15.2	22.8	30.4	38.0	45.6	53.2	60.8	68.4
72.5	80	121	16.0	24.0	32.0	40.0	48.0	56.0	64.0	72.0
75	85	128	17.0	25.5	34.0	42.5	51.0	59.5	68.0	76.5
77.5	89	135	17.8	26.7	35.6	44.5	53.4	62.3	71.2	80.1
80	94	142	18.8	28.2	37.6	47.0	56.4	65.8	75.2	84.6
82.5	99	150	19.8	29.7	39.6	49.5	59.4	69.3	79.2	89.1
85	104	153	20.8	31.2	41.6	52.0	62.4	72.8	83.2	93.6
87.5	109	165	21.8	32.7	43.6	54.5	65.4	76.3	87.2	98.1
90	114	173	22.8	34.2	45.6	57.0	68.4	79.8	91.2	102.6
92.5	119	180	23.8	35.7	47.6	59.5	71.4	83.3	95.2	107.1
95	124	188	24.8	37.2	49.6	62.0	74.4	86.8	99.2	111.6
97.5	129	196	25.8	38.7	51.6	64.5	77.4	90.3	103.2	116.1
100	134	204	26.8	40.2	53.6	67.0	80.4	93.8	107.2	120.6

* For 1/4 chain (1/10 of tape length) point off one place to left the values given in this column

	Outline
Sketch	Notes. Comp., Rch
Jones	Rch. Ab

B-10

State Virginia

Block 10

Date 3/25/46

Sheet No. 34

Topographic Features

Description of Point: A-11 | B-11
Starting Point: A-10 | B-10

Stake in Cor. Post
1 Y.P. BT. 2 K's

Description of Starting Point

Distance	Abney Reading(s)	Advance Taken	Remarks
0.00			Running North
[illegible]	-17	6	
10	4-21, 6-37	17½	
12.5	+2	0	
10.0	+11	2½	
15.0	+24	10	
[illegible]	+27	13	
17.5	+19	6	
[illegible]	+10	2	Set K on S face of 22" Pe"19.66 StoGC"
[illegible]	+14	3½	
[illegible]	7+13, 3+0	2	
[illegible]	-17½	6	
[illegible]	-20½	7	
31.33	-24	142-91lks	The top of cliff at 31.33 no tree for K
[illegible]	-82	250 lks	Rd.
[illegible]	-34	Tr.	
10	0	0	
[illegible]	-16	5"	
[illegible]	5-31, 5+29	16	Unable to find 1/4 C. set K on 20"
[illegible]	+25	11	poplar. 39"39.23 S to GC"
[illegible]	+13	3	
[illegible]	+8	1	Set K on 16" YP "47.57 S to GC"
[illegible]	+3	0	
[illegible]	+5	1/2	
[illegible]	+2	0	
[illegible]	5-0, 5-6	0	
[illegible]	+9	2	Set K on S face of 30" WO "60.32 S to GC"
[illegible]	-12	3	
[illegible]	-15	4	At 63.1 ruins of a cabin is 2.9 to W.
[illegible]	---	---	Run West. Offset to attempt to be on line
1.0	+5	1/2	
[illegible]	---	---	Run North
2.5	+1	0	Set K on 40" YP "67.18 S" to GC"
[illegible]	-10	2	
[illegible]	-17	6	
[illegible]	-19	7	
[illegible]	-20	7	
[illegible]	-30	[illegible] lks	back on line
[illegible]	---	---	Run West
5.1	0	0	To set GC A-12 | B-12 Cor Post set 3 K's

FIGURE 4

Sketch to accompany example of chaining down precipice.

Profile of slope.

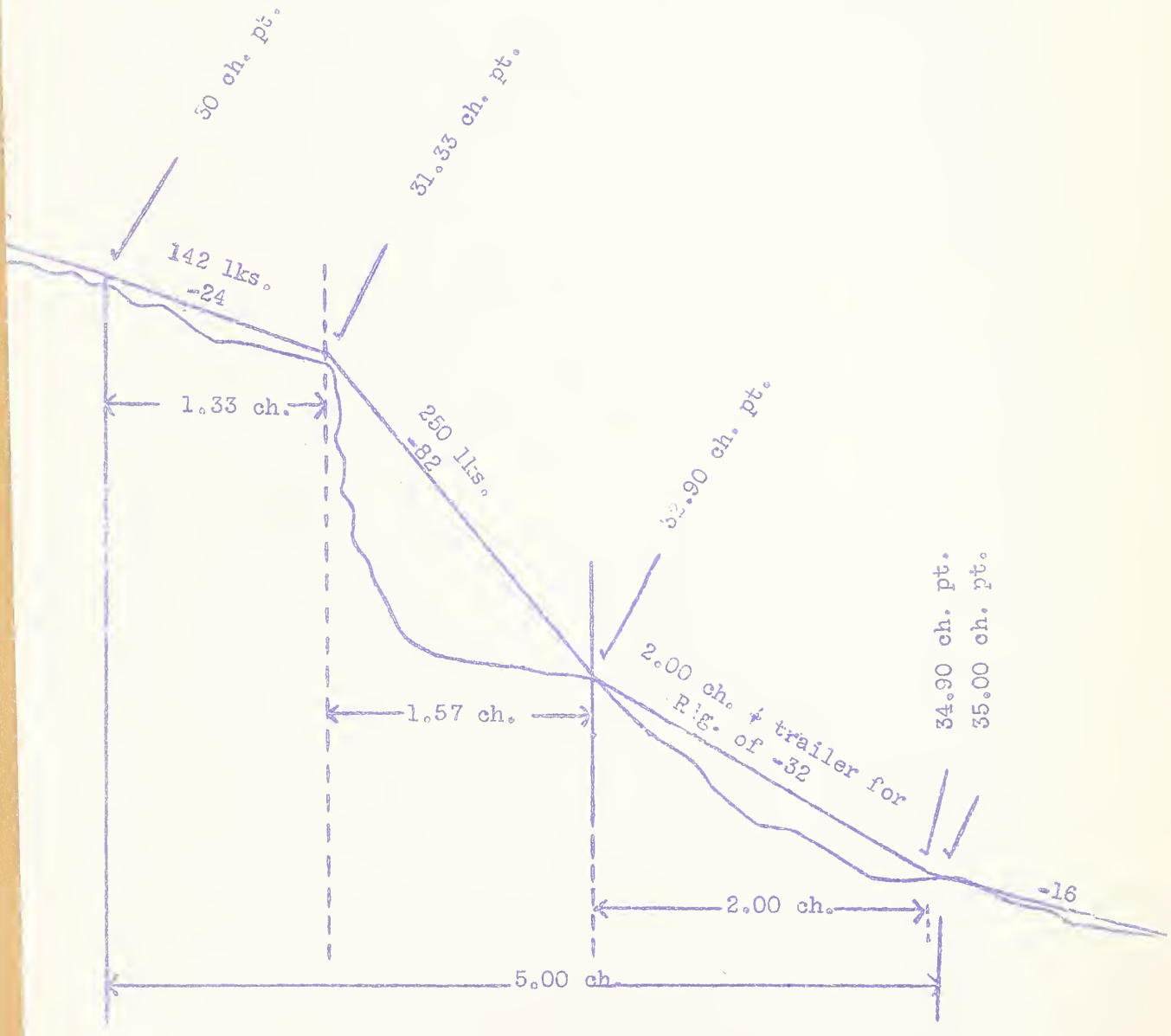
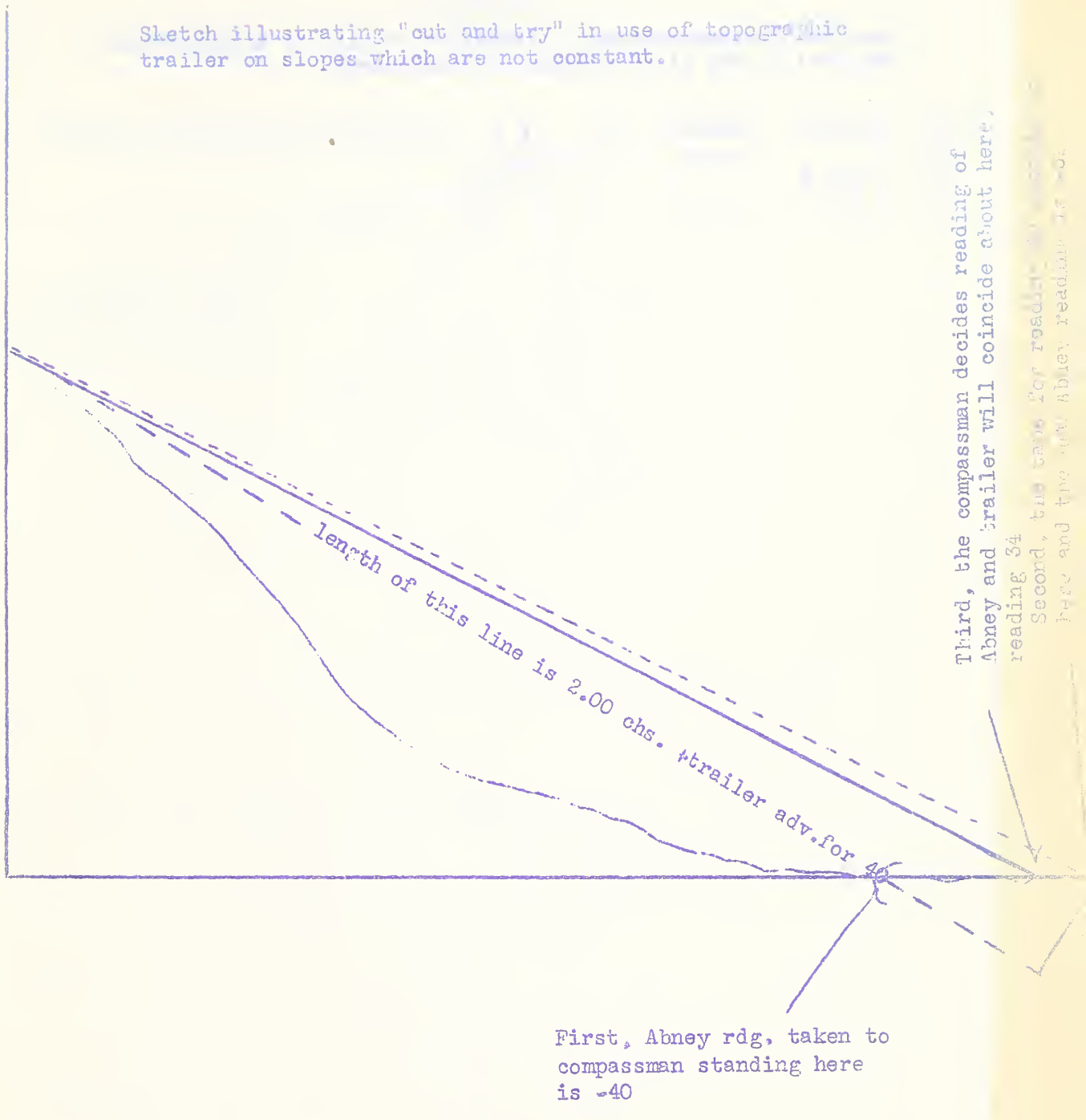
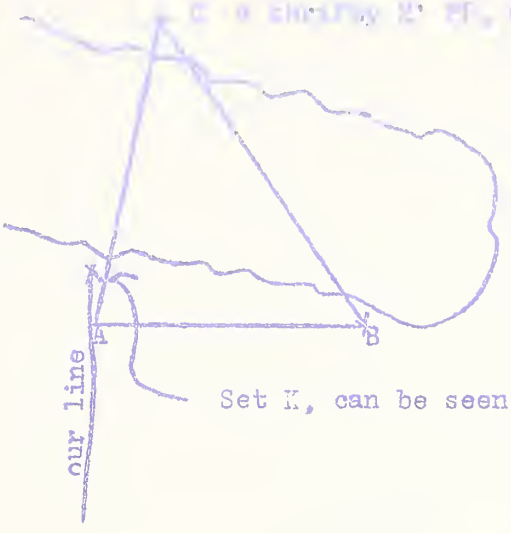


FIGURE 5

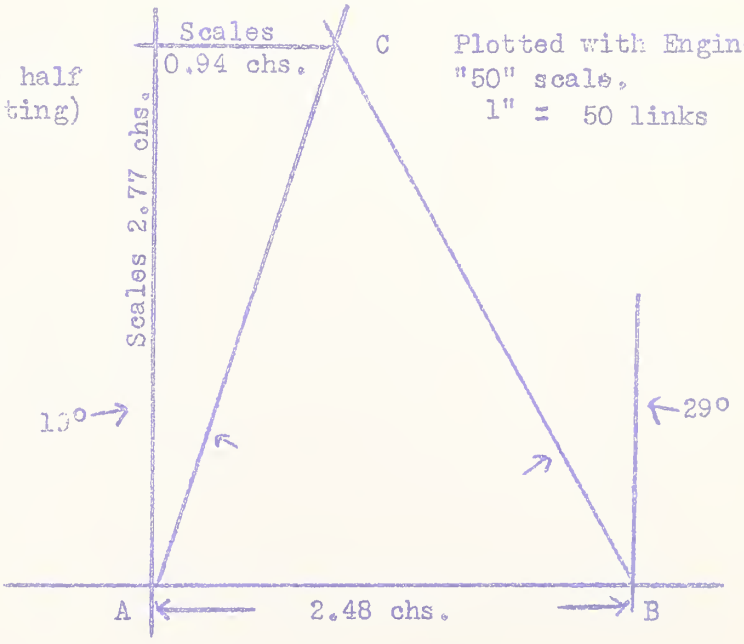
Sketch illustrating "cut and try" in use of topographic trailer on slopes which are not constant.





Solution as determined in camp by plotting with protractor and scale:

(This drawing is one half size of actual plotting)



taken is -82. Referring to Table T-7, page 44, the compassman sees by inspection that the horizontal distance is 157 links, and makes the necessary entries on the data sheet. The total distance to this point is, therefore, 52.90 chains.

The compassman, however, wishes to have the total distance returned to intervals of 2-1/2 chains as soon as possible. Therefore he decides to make the next shot an even 2-chains obtaining horizontal distance from the trailer. He has the rear-chainman stop him at a little over 2-chains and take a trial Abney reading, which is -40. Now he has the rear-chainman give him 2-chains plus the advance for 40 and takes another Abney reading while he stands at this new trial point. (See Figure 5). At this new point the reading is -32. The compassman now knows that the Abney reading and the trailer reading will coincide at some point on the ground which is near to a measured distance from 34 on the trailer. Accordingly, he instructs the rear-chainman to stick him from the 34 mark on the trailer. Then he has the rear-chainman take a final Abney reading to verify his assumptions. Since small errors are of no consequence, he is satisfied if this final Abney reading is near to 34. 1/ The point at which the compassman stuck is 34.90 chains. He measures another 10 links to the 35 chain point. As the necessary departure from chaining is 2-1/2 chain intervals has changed the normal count of tally rags, the rags are now adjusted so that the compassman holds two, one is on the 35 chain mark and the rear-chainman holds 5. Care is always taken to eliminate any possibility of a 2-1/2 chain mistake.

TRIANGULATION

There are rare occasions where the distance is needed across a stream or gorge impassable to chaining either on line or on an offset. Usually a point on the far side of the impassable region can be established from which the line may be resumed. Figure 8 will illustrate the method of a simple form of triangulation to be solved by plotting with no computation necessary. Ordinarily the plotting is done in the office but it can be done in the field, using the protractor of the Forest Service standard compass. The method requires: (1) The selection of the nearest convenient unmistakable object across the impasse; (2) A measured base line which for ease in plotting is, if practicable, cardinal and at right angles to the cardinal control line being run; this base for accuracy of the result should be about as long as the estimated distance from either end of the base line to the objective; (3) A sketch of the situation showing necessary notations as to positions, distances, and bearings; (4) A plot of the solution to a scale permitting accuracy within a few links, /(3) and (4) are combined if the solution is desired in the field before returning to camp/.

1/ Note that the use of the trailer where the slope is not constant is subject to "cut and try". It is appropriate in cases of this kind to make a compromise to save time by allowing a little error.

[illegible] SURVEY CREW

Generally the 2-1/2 chain method of Compass and Tape Survey is conducted by a 2-man crew. The compassman acts as mapper, note recorder and head chainman. The rear-chainman takes slope readings and sets location tags. However, in running in our own grid survey in the Southern Appalachians we are often confronted with topographic difficulties which call for the use of three and sometimes four men. Our aim should be to use no more than three men. The third man is used to cut brush, assist the compassman get his line of sight by going ahead, marking line and assisting in the cutting and setting of line stakes and corners. The control survey crew should be made up of physically fit men and the chief of party must be thoroughly familiar with the methods outlined in the manual before he is put on his own. A new crew must be constantly checked and mistakes corrected before they go too far. Every new crew must run in a complete closed grid traverse before he goes on to use any other method, variation or short cut.

A number of problems will confront the control survey crew as the work progresses. With experience and the exercise of good judgement most difficulties can be avoided or corrected.

(a) The Crew: Keep the crew well organized. See that each man has a definite duty to perform.

(b) Care in Chaining: Some common mistakes made by inexperienced chainmen are:

1. Adding or dropping a full tape length. This can be avoided if both chainmen count the chains. The rear-chainman should always call out the chain number and the head chainman should repeat the number. Large mistakes can often be avoided if the chainmen form the habit of pacing or estimating distances. The use of cloth tags or metal arrows dropped by the head chainman and picked up by the rear-chainman is an excellent way to keep track of chains run.

2. Not holding the tape straight when in use. Accurate measurements cannot be taken if the chain is swung around brush or other obstructions. If necessary "break chain". ("Breaking chain" means the measurement of fractional distances). Keep the chain taut. Do not allow it to kink. If the chain becomes entangled by no means give it a jerk in an attempt to free it. Band chains are tough but if allowed to become twisted they break easily under tension.

(c) Improper marking of location markers, tags, line stakes and corners.

There is no excuse for wrongly marking a location marker, tag, line stake or corner. As previously described, tags should be marked up ahead to cover each 20 chains run. The improper marking of location markers and corners would be extremely confusing so great care should be experienced in posting location markers and in scribing corners.

INSTRUMENTS AND THEIR USE

The Forester's Compass Used on Control Survey

Extreme care must be exercised in using a surveyor's compass. On set up points be sure the Jacob's staff is set firmly in the ground. Place the compass on the screw head of the ball and socket joint, raise the sights, level by means of the circular spirit level, and release the needle. At each observation the compass box should be tapped lightly with a pencil as the needle comes nearly to rest. This is done so there may be no adhesion between the jewel of the needle and the point. Do not rub the glass since this will produce static charges of electricity which will cause the needle to stick. A moistened finger pressed against the glass will remove static charges.

The angle between the true meridian and magnetic meridian is called the magnetic declination. In order to run true lines in any particular area, the variation of the needle is set off by revolving the raised compass ring by means of a slotted screw projecting through the side of the compass box. If the direction of rotation from the true meridian to the magnetic meridian is clockwise, the declination for the particular area to be surveyed is not already known, an isogonic chart of the United States can be obtained from the U. S. Coast and Geodetic Survey. From this chart the declination may be estimated for any part of the United States with sufficient precision for most purposes.

As soon as a compass reading is taken be certain that the needle is clamped before moving the instrument. Keep sources of attraction such as axe, and pocket knives away from the instrument when readings are being taken. Always read the north end of the needle. In order not to confuse the north and south ends of the needle when taking bearings, note the position of the counter-balancing wire which is always placed on the south end of the needle.

The Abney

Although the Abney is by no means a high precision instrument like the transit or level, the numerous activities to which it is adapted, its ruggedness, simplicity and ease of operation have made the Abney a favorite instrument for field use. With a little experience in its use a remarkable degree of precision can be obtained.

It will only be attempted here to describe the use of the Abney in connection with reducing slope distances to horizontal distances, using the topographic are in conjunction with the topographic tape. For other uses and adjustments of the Abney, reference is made to "The Abney Level Handbook" published by the Forest Service. This handbook was written by H. A. Callins and J. B. Yule and can be purchased for 10¢ per copy from the Government printing office in Washington, D. C.

The topographic arc on the Abney is based on an angular unit based on the ratio of one unit vertically to 66 units horizontally and was designed to be used with the topographic tape. Used together the purpose is to reduce slope distances to horizontal distances.

In using the Abney in connection with the 2-1/2 chain method of Compass and Tape Survey the readings are converted to plus or minus advances in feet by referring to the proper conversion table (See Table T-1 on page13).

The Abney is generally carried and used by the rear-chainman. The height of instrument (H.I.) is obtained by both chainmen standing on level ground several feet apart. The index arm is set at zero on the graduated arc and the rear-chainman moves the instrument slowly up and down until the center mark on the bubble tube "splits" the bubble. The rear-chainman then notes where his line of sight falls on the head chainman. It may be on his eyes, nose, mouth, chin, etc. Readings in the field are always taken by sighting on the point of (H.I.) and the index arm moved until the bubble is leveled.

The details of using the Abney in connection with the 2-1/2 chain method of Compass and Tape Survey has already been full described. However, it will sometimes be advisable to use the trailer in determining horizontal distances and the following example shows how this is done.

Suppose for instance, a two chain "shot" is taken and it is noted that the Abney reads 30. The rear-chainman then locates the 30 correction mark beyond the two chain brass tag and the head chainman pulls the tape taut. The horizontal distance is now two chains. If one chain "shots" are taken the correction is made as above, the corresponding correction graduations being on the back of the tape just following the one chain brass tag. For determining horizontal distances from fractional chain lengths. (See tables T-5, pages 41 & 42).

The use of the Clinometer in Obtaining Degree of Slope for Reducing Slope Distances to Horizontal Distances.

Although the use of the topographic Abney is recommended, the pendulum clinometer which is incorporated in the Forester's and Geologist's type of surveying compass may be used. When it is necessary to take a slope reading the compassman will lower the horizontal plate of the compass, (only after firmly locking the needle) to a vertical position. A groove provided in the socket will allow the standard arm to drop. Before taking a reading it is necessary that the pendulum swings free. A sight is then taken on the rear-chainman and the degree of slope read. Tables T-3 and T-4 on pages 39 & 40 incl., are to be used when slope readings are taken with a clinometer. Table T-3 converts degrees to topographis, and table T-4 converts percent of slope to topographic. Table T-2 on page 38 gives advances in feet with percent Abney or Clinometer when using the 2-1/2 chain method of Compass and Tape Survey.

Other Equipment Needed for Control Crew

Each crew should provide themselves with good boots and adequate clothing since control surveying is performed in all kinds of weather and over all types of topography, a good deal of which is very rough.

ITEM	REMARKS
COMPASS Type - Forester's and Geologists	Check each day to see if in good working order. Rear and Foresight bars tight, sight hair in place and taut. Declination properly set, Pendulm clinometer works free. Ball & Socket joint in good order. Check all set and capstian screws to see that none are lost or loose. Keep in case when not in use - after locking needle.
JACOB STAFF Standard Height - 54 inches	Check for splits and that metal shoe is securely fastened to shaft and point sharp. See that staff is properly marked off in feet. Never throw Staff, it may break or hurt someone.

ITEM	REMARKS
CHAIN Type - Topographic 2 Chains with Trailer, $\frac{1}{4}$" wide. Graduated in links (166 foot)	Keep chain clean. Do not roll while wet. Dry off with rag. Check for weak sections. Keep on hand supply of chain menders. Avoid kinks and roll and throw chain carefully after use. Check mender at 2-1/2 chain length to see if it is tight. If in doubt remeasure trailer from last brass tab and reset mender at proper distance (33 feet from 2-chain brass tab on trailer).
ABNEY LEVEL Type - Topographic Length $6\frac{1}{4}$"; extending to 7-3/8"	See that level is properly adjusted. Check at least twice a week to see that bubble tube is parallel to line of sight. Study Abney Level Handbook for care, use and adjustments of Level.
MARKING RAGS OR METAL ARROWS (Used to Mark Chaining Points)	Check marking rags to see that there are eight colored rags (preferably of red color), when dirty replace with new rags. If arrows are used tie red cloth to ring ends, fasten securely to belt ring.
HAND AXE Belt Type or Pole Axe. For cutting brush, blazing line and setting corners	Keep axe sharp and handle tight.
TIMBER SCRIBE Used for Marking Grid Corners, Location Stakes, etc.	Keep Scribe sharp. Provide sheath so that it will not be lost when not in use.
MARKING CRAYON	Always keep on hand some good Lumberman's marking crayons for marking stakes.
INDELIBLE PENCIL	Keep in holder and use for marking cardboard tags.

ITEM	REMARKS
TATEM HOLDER	Cloth, Steel or Aluminum. Used to keep data sheets and maps.
CARDBOARD TAGS	Never leave for field without supply of these tags. Mark up supply in advance.
PENCILS	Use fairly hard pencil so that data and maps will not be smudged. 3H or 4H preferable.
LOCATION MARKERS Scribe Tool No. 6 Galvanized Nails	Crew should carry 15 to 20 metal markers to be set up at corners and on line at 20 - 40 and 60 chain points as well as road and trail crossings.
SAFETY EQUIPMENT First Aid Kit Snake bite Kit First Aid Manual	 Always carry this with you. Always carry this with you Study Manual carefully and keep copy in truck.
AP-3 FORM (Daily Analysis Sheet)	Be sure you fill in heading completly and accurately. See that time recorded thereon checks with daily time sheet.
AP-6 FORM (Chaining Data Sheet)	This form is to be used for keeping track of chains run and advances taken to establish horizontal control. It also shows topographic and cultural features along line run.
TABLE T-1 or TABLE T-2	To be used for determining advances in feet for horizontal control when using topographic or percent Abney
TABLE T-3 or TABLE T-4	To be used for determining advances in topographic units when trailer is used in conjunction with clinometer giving degrees (T-3) or percent or percent Abney (T-4)

PRELIMINARY SURVEY

Before any original systematic survey is to be done, plans should be made in advance as to where the most logical place will be to start such a survey in respect to white pine, ease of getting crews into the area, estimation of cost of survey, number of men needed, transportation needed, whether existing maps, if any, are adequate, need of camps, etc. Preliminary surveys then may be defined as an extensive survey of general field conditions; inspecting all existing records and maps of the area and concluding whether or not the cost of a systematic survey will be warranted.

In the case of resurveying areas where fairly good original maps are available good use should be made of such maps in laying out the work plan for conducting the grid survey.

ESTABLISHING GRID CONTROL

As previously mentioned, our survey work is based on the square mile grid system. The grid when once established becomes our permanent control area unit for conducting white pine mapping, checking, ribes eradication and other projects directly related to blister rust control. By applying the methods of horizontal control grids are established in several different ways.

1. Straight grid survey in which all cardinal lines are run and established in the field with all corners set and location markers placed.

2. Modified grid survey in which grids are established from irregular base lines run along roads.

3. No base lines run. Survey based on accurate planimetric maps made from aerial surveys. In the use of planimetric maps the grid system is overlaid on the map. Control points are determined from the map such as where grid lines cross roads, road intersections, streams, rivers, permanent cultural features, etc. Such points are scaled from the map to the nearest grid corner. In the field this distance (converted to chains and links) is chained on the ground and the corner established. If the grid overlay on the map was done accurately and the chaining is carefully done the error between map scale and round measurement is very little, normally about one percent. First class maps, of course, must be used for establishing this type of control.

4. Establishing single base line through scattered pine areas falling within an overlaid grid system. This system has been used primarily in Maryland where accurate planimetric maps were not available when the original survey was performed.

Besides the above four methods, another system which was originally used in Tennessee established control by running base lines in cardinal direction spaced 2 miles apart. The present grid system was overlaid on the original base maps and henceforth all resurvey, checking and ribes eradication work will be by square mile grids.

THE GRID SYSTEM

After preliminary surveys are made, permanent starting points such as U. S. G. S. (first class) corners, Forest Service corners, bench marks or some other such permanent marker will be located within or near the white pine area to be surveyed. From a U. S. G. S. map, T. V. A. map, Forest Service map, County map or any other available map (always use the most up-to-date map) the prospective area to be surveyed will be laid off in square mile grids, later described. Since a better cross section of the country can be obtained by mapping at right angles to streams and ridges, the survey system should be laid off with this in mind. If, for instance, a drainage system runs in an east and west direction the primary grid base line should run east and west, starting from the permanent corner located by the preliminary survey. The mapping crews, later described, will run their strips north and south, tying in to the base lines.

By dividing the area to be surveyed into square mile grid units, the mapping system will be uniform. Control survey lines will be run parallel to the primary grid base line at one mile intervals.

In order to establish ground control for mapping square mile areas where no Congressional survey has been made a simple grid system can be used. Before any mapping is done in a country, a good county map should be obtained and gridded into square mile areas, using, of course, the same scale as shown on the map. Any map with a scale less than 1/2 inch to the mile should be enlarged. One inch to the mile is a good scale to use. U. S. G. S., quadrangle, T. V. A. or Forest Service maps may be used instead of county maps. If no maps are available a grid map can be built up as the field mapping is carried on, although the distance in miles should be known from some central starting point to at least two cardinal points on the county line. This is necessary to complete an orderly grid system of the county.

When some sort of county, U. S. G. S., Forest Service, T. V. A. or any other type of map is available, the first procedure is to locate an established U. S. G. S. or Forest Service corner. If no such corners can be located a bench mark or some well known permanent point may be used.

After the starting point is located on the map the first two grid lines running north and south and east and west are drawn, intersecting at the permanent point previously located on the map. Lines are then drawn in cardinal directions from the first two lines, one mile apart.

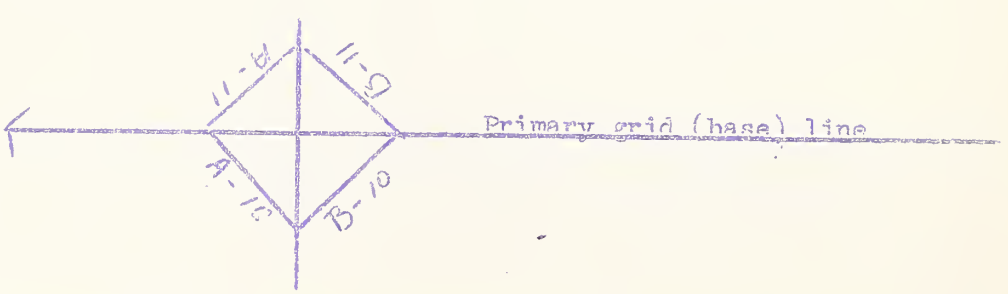
When the grids are completed, they are numbered from one on up on the right or left margin of the map and lettered A, B, C, etc., from left to right on the bottom of the map; thus a grid would be designated as A-1, C-4, G-12, etc. If the grid map is more than 26 grid units wide the letters following Z will become A', B', C', etc., and a grid would then be designated as A'-1, C'-4, etc. The sample grid map, (see page 2) illustrates how a grid map is built up with primary grid lines intersecting at a bench mark. Since the drainage is westerly the primary grid (base) line runs east and west from the starting point.

When the grid system was first laid out the plan was to have a separate grid system for each county. Later it was found advisable to group several counties under the same grid system. One large section in southwest Virginia is so laid out and because of the length east and west is so great the grids are designated by letters running from south to north and the numerals from west to east. In other sections the numerals are started at the top of the system and increased as they go south. There has been no objection to this as long as the base maps are properly designated.

After the grids are overlaid on the base map and properly designated the gridded area is laid off in 48 square mile blocks. The blocks are eight miles long by six miles wide. The use of blocks facilitates the ease of locating a particular grid. Thus grid A-10 may be confused with grid A'-10 but if a block number is given no confusion will result. One would say Block 10, grid A-10. Our platt maps are also based on the block. By platting all grid maps on 2" to the mile platt maps one can get a good idea as to the distribution of white pine and ribes over a large area. Thus, by the use of the grid system it is a simple matter to designate any white pine area by referring to the proper block and grid designation.

GRID CONTROL SURVEYING

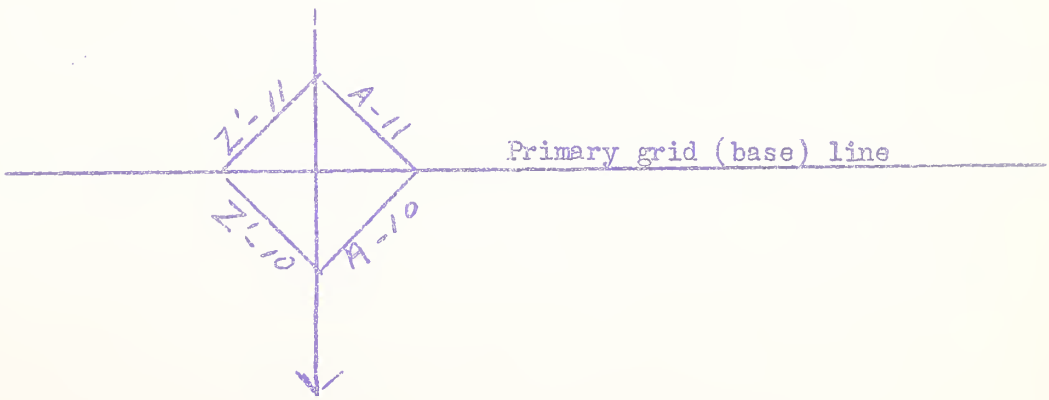
If the primary grid (base) line runs east and west from the starting corner and it is desired to start the survey west of the corner, the crew will set a four sided stake at this corner, setting it so each face will point diagonally into the grids, each face being numbered with the proper grid designation into which it faces. The following diagram shows how the corner stakes are to be set and numbered.



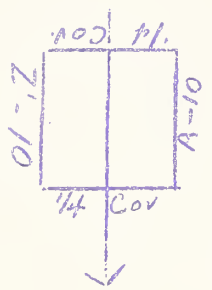
The corner stakes should be at least five feet high and four inches in diameter at the top.

After the corner is well set in the ground and properly marked the compassman sets up his compass and takes a sight due east. Before starting however, he carefully checks his equipment to see that he has all proper forms, 8 tally rags, pencil and cardboard tags marked up for the first 20 chains. After setting location markers the crew then starts out running in the control line as described under the 2-1/2 chain method previously described. As the line is run the compassman will note on his base map the scaled distance to any permanent marker along the line. When he reaches the designated point he will proceed to tie into the permanent marker to check the accuracy of his line. Remember, all tie-in lines are to be run in cardinal direction to avoid the trouble of using traverse tables. The method of tying into permanent markers is described on page 7. Properly marked cardboard tags will be set every five chains starting at the 2-1/2 chain mark for the starting corner. The proper marking of these tags for the control survey crew is described and illustrated on page 7. At the 20, 40 and 60 chain mark a metal location marker is tacked to the nearest tree on line. Its exact location is recorded in the survey notes. The method of setting and marking these location markers is described on page 30. In ribes-bearing country it is wise to set 1/4 corner stakes or mark a tree on or near the line at the 40 chain mark. If a stake is used it will be of the same size and height as the corner stake and marked as illustrated by the diagram shown below.

When the eighty chain mark is reached another corner stake will be set and marked with the proper grid designations. The side facing into the grid being surveyed will be marked accordingly. The other proper grid numbers will be marked on the other three faces as the following diagram illustrates; location markers will be tacked up near the corner.



Since location tags have been set every 2-1/2 chains along the east-west line we are assuming that the mappers will be running their strip lines north and south. Hence, after the 80 chain stake is set and properly marked the control survey crew will run a line due south setting only a 40 chain and 80 chain (corner) stake. The 40 chain stake will have marked on the two faces pointing opposite to the direction of the line the proper grid designations marked thereon as illustrated below.



When the mile mark is reached, running south, another four sided corner stake is set and properly marked. From this stake the crew will run east, setting tags every 2-1/2 chains. After the southeast corner is set the line will be run north, setting a 40 chain stake and tying into the original starting corner.

Although cardboard tags will often stay up over two seasons, it is usually wise to set line stakes at least every five chains if it is known that no work will be performed on the grid for one or more seasons. Line stakes should be 3 to 4 feet high and faced on two sides for writing on the chain number. Line stakes can be cut in the field.

On grids which are laid out for ribes eradication as well as mapping the grid lines should be well marked. Brush should be cut and trees blazed. In the blazing of trees care should be taken, however, not to blaze anything but scrub species. Paint can be used instead of blazing but be sure the color of paint used does not conflict with that used by the Forest Service or any other agency operating in the same territory.

So far we have described the method of running control lines on a single grid. This, of course, represents a closed traverse survey. Normally this is not always done because of the cost involved and for this reason, especially in ribes-free country we do not need such an accurate survey. For instance, if there are enough control tie-in points and the base map used is accurate most tie-in lines - either north or south or east and west - depending on which lines the strip stakes or tags are to be set, can be disregarded. Nevertheless, it must be remembered that

in ribes-bearing country where white pine is to be protected the control lines must be accurately and permanently established. A little extra cost here will probably be offset by savings in time and money on subsequent work.

Error of Closure:

In tying in a square mile grid an error of closure (angular and linear) should not exceed 1/4 chain (16½ feet) in the four miles run. An error of one chain may be allowed if the chief of party makes a notation of the error so a correction can be made on the grid base map. If the error of closure is greater than one chain, the lines should be re-run; resetting all line stakes and tags accordingly. It, therefore, should be impressed upon the chief of party that he is responsible to make accurate notations on all closures and tie-in points. If this is disregarded, confusion will result which may mean that a whole block of grids will have to be re-run to straighten out cumulative errors because errors of closure were disregarded.

TYING GRID CONTROL LINES INTO PERMANENT MARKERS
(Forest Service Class "A" Corners, Bench Marks, etc.)

In order to check on the accuracy of the control line being run especially when an accurate base map is used, various markers which fall within reasonable distance of the line should be tied in. Thus, the base map shows a Class "A" Forest Service corner 2-1/2 chains north and 43 chains west of the starting grid corner. When the crew reaches the 43 chain mark a line should be run due north for 2-1/2 chains and a search made for the corner and proper notes made on the chaining data sheet (form AP-6). If the corner is found within one chain of where it is designated on the map the error can be disregarded. If more than one chain, a recheck of the line should be made both on the base map and in the field. All tie-in lines must be run in cardinal direction to avoid the use of traverse tables.

USE OF AERIAL PHOTOGRAPHS

Only recently have we attempted to use aerial photographs in the field for establishing control. There are many problems which arise in the use of aerial photographs. Before they can be used with any degree of accuracy the photographs must be corrected for distortion. This is done by overlaying adjacent photographs and eliminating those parts which do not match. By trimming, cutting and stapling them, a fairly accurate composite photograph of the area can be had. After the photographs are matched, grid lines are overlaid in ink and they are then ready for field use or for use in making a corrected planimetric base map. Photographs which we use are normally of a scale of 1:20,000 which is a little less than 4" to the mile.

Individual photographs can be used in the field since one photograph will usually take in several partial grids after corrections have been made for distortion.

More experience is needed in applying aerial photographs in establishing ground control for conducting blister rust work in our region. Better and simpler methods have been developed during the last few years and it is hoped that we will be able to benefit by them when available for our use.

See page 51 for explanation of control established from Planimetric maps made from aerial photographs.

THE GRID LOCATION MARKER

We have attempted in the past to use a standard type of rid location marker. The markers used, however, were of wood, too large and were not securely fastened to the posts. The markers were too conspicuous and many were destroyed.

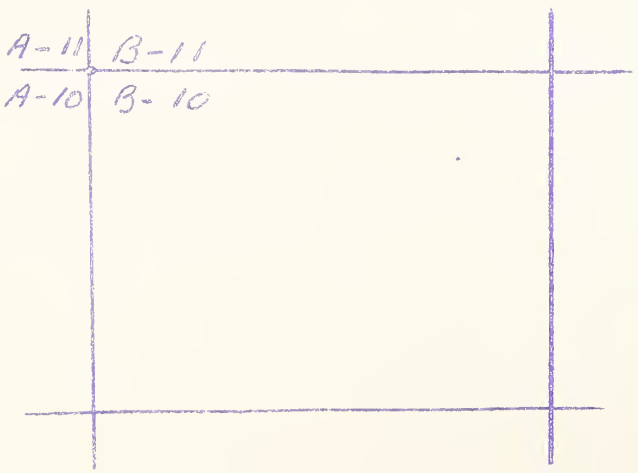
The need of a good permanent location marker to designate grid corners and grid line locations is great since a good deal of time is wasted in trying to locate an old grid line or corner if it is not well posted.

A new type of marker has been devised which is to be made out of half hard aluminum of .025 gauge; dimensions approximately 4 x 5 inches. Below is a drawing of the type of marker which we will use throughout the region.

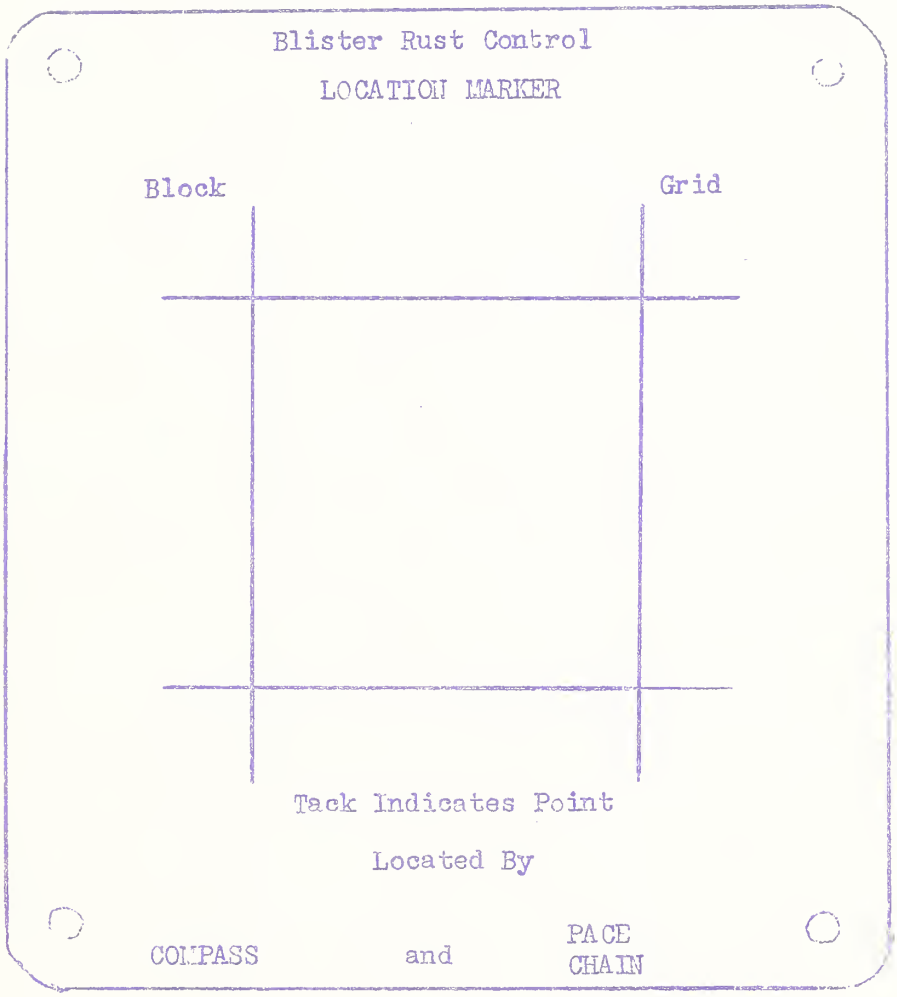
NOTE: SEE PAGE 31 ——————————→

These markerw will be set at all established grid corners; one on the corner itself and at least two others on nearby trees facing towards the corner. The block number will be scratched in as well as the grid designations. The tack will then indicate the position of the corner in relation to the four grids common to the corner.

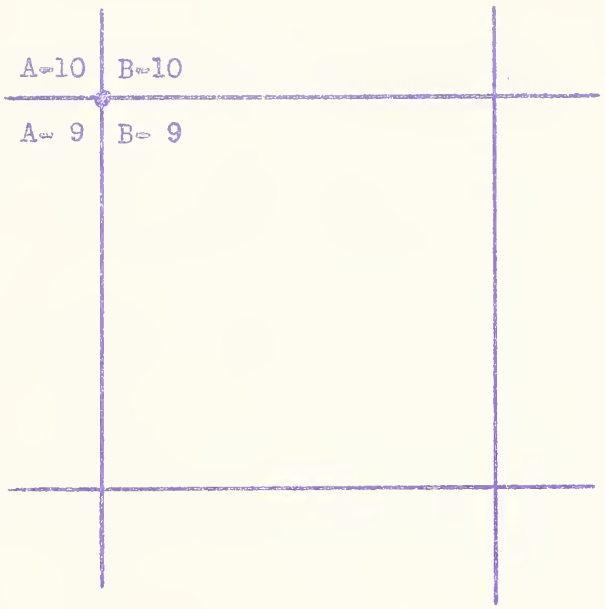
Example of placing location marker at corner:



NEW TYPE MARKER

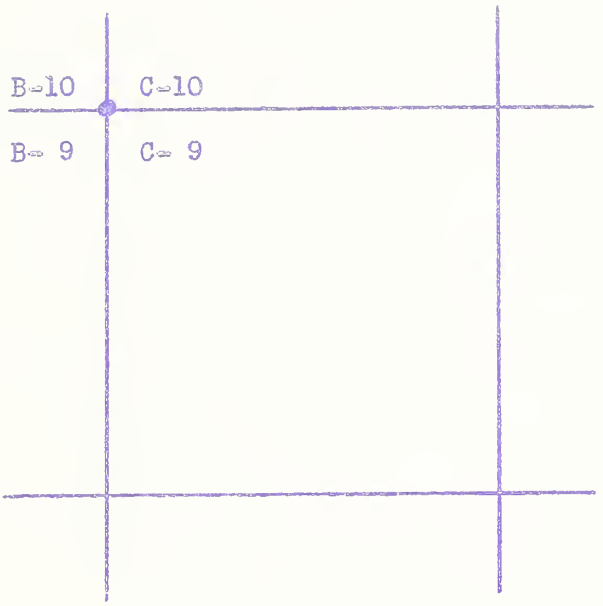


In order to have uniformity in placing markers at grid corners, always place tack on northwest corner of 2" square. Thus, if the location marker was placed at the southwest corner of B-10 the designation would be:

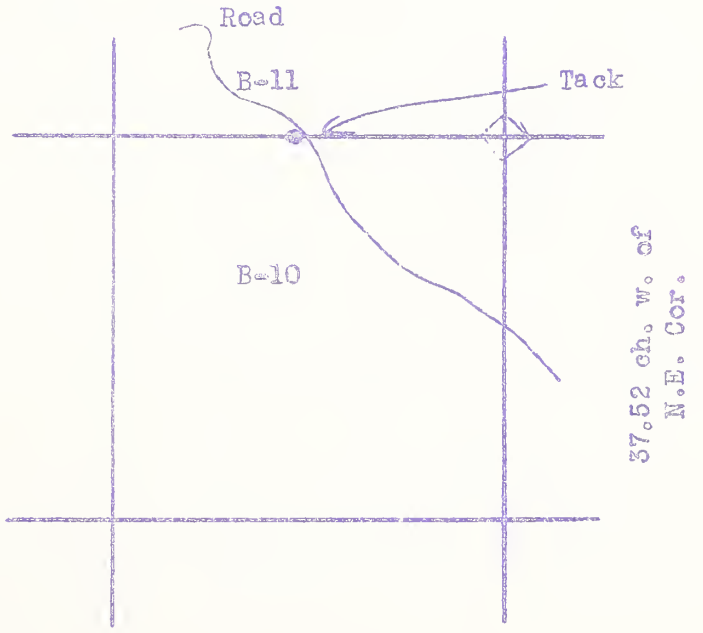


If placed on the northeast corner of B-10 it would be:

If on the southeast corner of B-10 it would be:



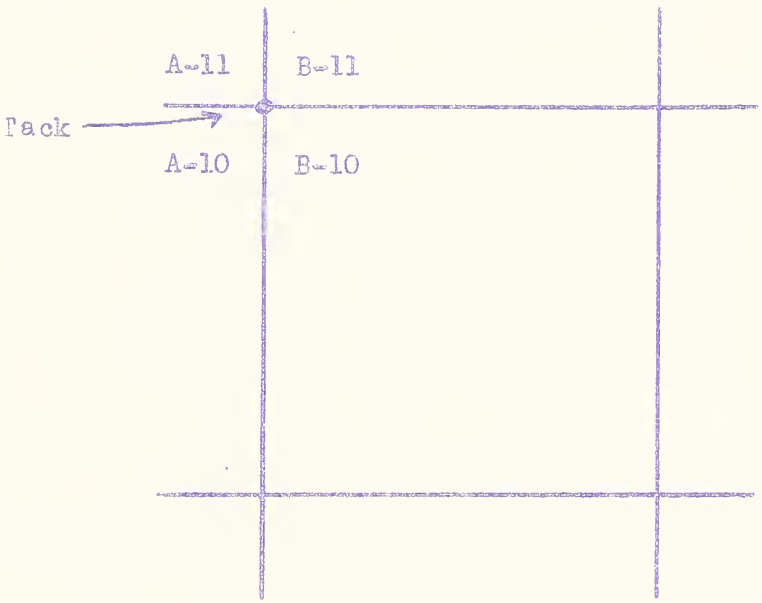
When location markers are placed along roads where grid lines cross, the tack will be placed on the line and the distance to the nearest grid corner indicated thereon. See example below:



The figures 37.52 mean that the intersection of the road and grid line (indicated by tack) is 37 chains 52 links due west of the northeast corner of grid B-10.

The grid designation following the word GRID on the face of the form will always be the grid falling within the 2" square. Example below:

BLOCK 10 GRID B-10



For scribing in the grid numbers, a good sharp scribing tool should be used. A good tool is to take a cheap awl, cut the point off to within 3/4 of an inch from the handle and sharpen to a point. A suitable sheath shouldd be provided to carry the awl so that there will be no danger of injuring the bearer when not in use.

For markers to be set at grid corners, the grids can be stamped on the marker prior to going to the field. This would be a good job for rainy days.

Galvanized nails will be used to attach the markers to trees or posts. A number six nail should be used. In placing the markers on living trees the nails should not be driven in flush but left protruding a fraction of an inch. If driven flush the diameter growth of the tree will, in a few years, force the marker off the tree.

Where ground control is established by road traverse, markers are to be placed along the base line where the grid lines cross. With the distance indicated thereon to the nearest corner, whether the corner is established or not. If a corner is established the proper intersecting lines are to be marked thus, ⊣⊢ if not established, thus ┼.

Extreme care must be taken in scribing and setting these markers. Wastefulness will not be tolerated.

THE LOCATION TAG

The cardboard location tag has become an indispensable item as used in conjunction with survey and checking work. The location tag has several functions:

1. It indicates the location of a particular point in relation to the base lines or grid corners.

2. It shows the direction in which survey or check strips were run.

3. It facilitates the relocating of strips along roads and trails thus reducing time lost in picking up uncompleted strip lines.

4. It makes it much easier for the field supervisor to keep tab on his crew.

5. It provides good visible tie-in markers along base lines.

There has been considerable variation in marking up tags both by checkers and survey crews. It will be much more desirable if we have a standard method in doing this and the following diagrams and illustrations will show how this is to be done.

1. The Survey Crew

The survey crew will set tags every 2-1/2 chains along grid lines. (For setting tags along road traverse base lines refer to section on establishing base lines by road traverse on page 45).

The control survey tags will be set and the location designated from the starting corner. Thus, if the crew starts at the northeast grid corner of grid B-10 and the line is to be run west, the first tag will indicate the distance from the grid corner or 1/4 corner. See example on page 7 of Part II

By setting tags every 2-1/2 chains the time spent by the mappers and checkers looking for the nearest location point will be reduced to a minimum. Of course, the spacing of these tags will vary in different parts of the region. Thus, on a resurvey in known ribes-free country the number of tags set per mile can be reduced. Nevertheless, enough tags must be set to aid the mapper in locating himself when he reaches the base line. The following rule is suggested for different spacing of mapping and check strips.

1. Only four strips through a grid: set tags every 10 chains with the first tag set 5 chains from the starting corner.

2. Eight strips through a grid for mapping purposes only: set tags every 5 chains with the first tag set 2-1/2 chains from the starting corner.

3. Eight or sixteen strips through a grid for mapping and checking; set tags every 2-1/2 chains with the first tag set 2-1/2 chains from the starting corner.

To mark the tags use an indelible pencil and press hard to make an impression on the tag. Some of the tags will often stay up for two or more seasons, and if properly marked will be legible. Location tags used by checkers and mappers are explained under Part III of this manual

PART II

SAMPLE MAP SHOWING

SYSTEM FOR CONDUCTING

GRID CONTROL SURVEY.

SCALE $\frac{1}{2}$" 1 MILE

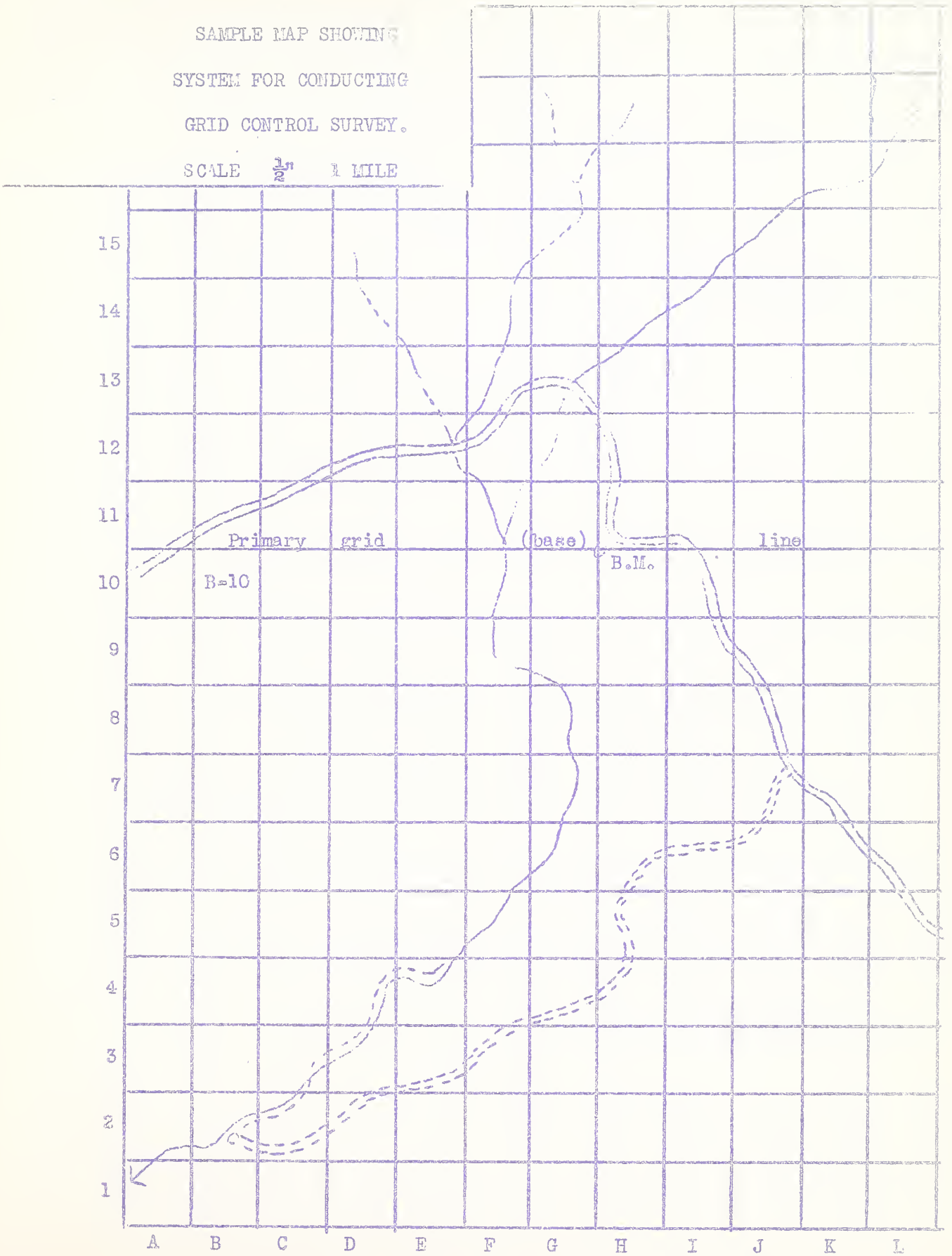


TABLE 1.2

TABLE FOR USE WITH PLANE LINE

Values in body of table are ADVANCES to be taken on slope to give horizontal distance

Slope in PERCENT	Horizontal distance straight on the slope									
	2 1/2 Chains* 10/10	1/2 Chain 2/10	3/4 Chain 3/10	1 Chain 4/10	1 1/2 Chains 5/10	1 1/2 Chains 6/10	1 5/4 Chains 7/10	2 Chains 8/10	2 1/4 Chains 9/10
Units	ft. Links	Advances in feet								
5	1/4									
10	1	2	2	3	.4	.5	.6	.7	.8	.9
15	2	3	.4	.6	.8	1.0	1.2	1.4	1.5	1.8
20	3	5	.6	.9	1.2	1.5	1.8	2.1	2.4	2.7
25	5	8	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
30	7	11	1.4	2.1	2.8	3.5	4.2	4.9	5.6	6.3
35	10	15	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
40	13	20	2.6	3.9	5.2	6.5	7.8	9.1	10.4	11.7
45	16	24	3.2	4.8	6.4	8.0	9.6	11.2	12.8	14.4
50	19	29	3.7	5.7	7.6	9.5	11.4	13.3	15.2	17.1
55	23	35	4.6	6.9	9.2	11.5	13.8	16.1	18.4	20.7
60	27	41	5.4	8.1	10.8	13.5	16.2	18.9	21.6	24.3
65	32	48	6.4	9.6	12.8	16.0	19.2	22.4	25.6	28.8
70	36	55	7.2	10.8	14.4	18.0	21.6	25.2	28.8	32.4
75	41	62	8.2	12.3	16.4	20.5	24.6	28.7	32.8	36.9
80	46	70	9.2	13.8	18.4	23.0	27.6	32.2	36.8	41.4
85	52	79	10.4	15.6	20.8	26.0	31.2	36.4	41.6	46.8
90	57	86	11.4	17.1	22.8	28.5	34.2	39.9	45.6	51.3
95	63	95	12.6	18.9	25.2	31.5	37.8	44.1	50.4	56.7
100	68	103	13.6	20.4	27.2	34.0	40.8	47.6	54.4	61.2
105	74	112	14.8	22.2	29.6	37.0	44.4	51.8	59.2	66.6
110	80	121	16.0	24.0	32.0	40.0	48.0	56.0	64.0	72.0
115	86	130	17.2	25.8	34.4	43.0	51.6	60.2	68.8	77.4
120	93	142	18.5	27.9	37.2	46.5	55.8	65.1	74.4	83.7
125	99	150	19.8	29.7	39.6	49.5	59.4	69.3	79.2	89.1
130	106	161	21.2	31.8	42.4	53.0	63.6	74.2	84.8	95.4
135	112	170	22.4	33.6	44.8	56.0	67.2	78.4	89.6	100.8
140	119	180	23.8	35.7	47.6	59.5	71.4	83.3	95.2	107.1
145	126	191	25.2	37.8	50.4	63.0	75.6	88.2	100.8	113.4
150	132	200	26.4	39.6	52.8	66.0	79.2	92.4	105.6	118.8

TABLE I-3

EQUIVALENTS OF DEGREES IN TOPOGRAPHIC GRADUATION

Degrees	Topographic	Degrees	Topographic	Degrees	Topographic	Degrees	Topographic
1	1.15	16	18.93	31	39.66	46	68.54
2	2.30	17	20.18	32	41.24	47	70.78
3	3.46	18	21.44	33	42.86	48	75.30
4	4.62	19	22.73	34	44.52	49	75.92
5	5.77	20	24.02	35	46.21	50	78.66
6	6.94	21	25.33	36	47.95	51	81.50
7	8.10	22	26.67	37	49.73	52	84.48
8	9.28	23	28.02	38	51.57	53	87.58
9	10.45	24	29.39	39	53.45	54	90.84
10	11.64	25	30.78	40	55.38	55	94.26
11	12.83	26	32.19	41	57.37	56	97.85
12	14.03	27	33.63	42	59.43	57	101.63
13	15.24	28	35.09	43	61.55	58	105.62
14	16.46	29	36.58	44	63.74	59	109.84
15	17.68	30	38.11	45	66.00	60	114.32

Note: Above table taken from "The Abney Level Handbook", by H. A. Calkins and J. B. Yule.

TABLE T-4

EQUIVALENTS OF PERCENTS IN TOPOGRAPHIC GRADUATIONS

Per cent	Topographic	Per cent	Topographic	Per cent	Topographic	Per cent	Topographic
1	0.66	6	3.96	11	7.26	16	10.56
2	1.32	7	4.62	12	7.92	17	11.22
3	1.98	8	5.28	13	8.58	18	11.88
4	2.64	9	5.94	14	9.24	19	12.54
5	3.30	10	6.60	15	9.90	20	13.20
21	13.86	41	27.06	61	40.26	81	53.46
22	14.52	42	27.72	62	40.92	82	54.12
23	15.18	43	28.38	63	41.58	83	54.78
24	15.84	44	29.04	64	42.24	84	55.44
25	16.50	45	29.70	65	42.90	85	56.10
26	17.16	46	30.36	66	43.56	86	56.76
27	17.82	47	31.02	67	44.22	87	57.42
28	18.48	48	31.68	68	44.88	88	58.08
29	19.14	49	32.34	69	45.54	89	58.74
30	19.80	50	33.00	70	46.20	90	59.40
31	20.46	1	33.66	71	46.86	91	60.06
32	21.12	52	34.32	72	47.52	92	60.72
33	21.78	53	34.98	73	48. 18	93	61.38
34	22.44	54	3 .64	74	48.84	94	62.04
35	23.10	55	36.30	75	49.50	95	62.70
36	23.76	56	36.96	76	50.16	96	63.36
37	24.42	57	37.62	77	50.82	97	64.02
38	25.08	58	38.28	78	51.48	98	64.68
39	25.74	59	38.94	79	52.14	99	65.34
40	26.40	60	39.60	80	52.80	100	66.00

TABLE T-5

CONVERSION OF SLOPE DISTANCES TO HORIZONTAL DISTANCES
(For fractional chain lengths)

Topographic Abney and 1-chain (100 links) tape

Slope distance in links	TOPOGRAPHIC											
	5	10	15	20	25	30	35	40	45	50	55	60
2	2.0	2.0	2.0	1.9	1.9	1.8	1.8	1.7	1.7	1.6	1.5	[illegible]
4	4.0	4.0	4.0	3.8	3.7	3.6	3.5	3.4	3.3	3.2	3.1	[illegible]
6	6.0	5.9	5.9	5.7	5.6	5.5	5.3	5.1	5.0	4.8	4.6	[illegible]
8	8.0	7.9	7.8	7.7	7.5	7.3	7.1	6.8	6.6	6.4	6.1	[illegible]
10	10.0	9.9	9.8	9.6	9.4	9.1	8.8	8.6	8.3	8.0	7.7	[illegible]
12	12.0	11.9	11.7	11.5	11.2	10.9	10.6	10.3	9.9	9.6	9.2	[illegible]
14	14.0	13.8	13.7	13.4	13.1	12.7	12.4	12.0	11.6	11.2	10.8	[illegible]
16	16.0	15.8	15.6	15.3	15.0	14.6	14.1	13.7	13.2	12.8	12.3	[illegible]
18	17.9	17.8	17.6	17.2	16.8	16.4	15.9	15.4	14.9	14.3	13.8	[illegible]
20	19.9	19.8	19.5	19.1	18.7	18.2	17.7	17.1	16.5	15.9	15.4	[illegible]
22	21.9	21.8	21.5	21.0	20.6	20.0	19.4	18.8	18.2	17.5	16.9	[illegible]
24	23.9	23.7	23.4	23.0	22.4	21.8	21.2	20.5	19.8	19.1	18.4	[illegible]
26	25.9	25.7	25.4	24.9	24.3	23.7	23.0	22.2	21.5	20.7	20.0	[illegible]
28	27.9	27.7	27.3	26.8	26.2	25.5	24.7	23.9	23.1	22.3	21.5	[illegible]
30	29.9	29.7	29.3	28.7	28.1	27.3	26.5	25.7	24.8	23.9	23.0	[illegible]
32	31.9	31.6	31.2	30.6	29.9	29.1	28.3	27.4	26.4	25.5	24.6	[illegible]
34	33.9	33.6	33.2	32.5	31.8	31.0	30.0	29.1	28.1	27.1	26.1	[illegible]
36	35.9	35.6	35.1	34.5	33.7	32.8	31.8	30.8	29.7	28.7	27.7	[illegible]
38	37.9	37.6	37.1	36.4	35.5	34.6	33.6	32.5	31.4	30.3	29.2	[illegible]
40	39.9	39.5	39.0	38.3	37.4	36.4	35.3	34.2	33.0	31.9	30.7	[illegible]
42	41.9	41.5	41.0	40.2	39.3	38.2	37.0	35.9	34.7	33.5	32.3	[illegible]
44	43.9	43.5	42.9	42.1	41.1	40.1	38.9	37.6	36.4	35.1	33.8	[illegible]
46	45.9	45.5	44.9	44.0	43.0	41.9	40.6	39.3	38.0	36.7	35.3	[illegible]
48	47.9	47.5	46.8	45.9	44.9	43.7	42.4	41.0	39.7	38.3	36.9	[illegible]
50	49.9	49.4	48.8	47.9	46.8	45.5	44.2	42.8	41.3	39.9	38.4	[illegible]
52	51.9	51.4	50.7	49.8	48.6	47.3	45.9	44.5	42.0	41.4	39.9	[illegible]
54	53.8	53.4	52.7	51.7	50.5	49.2	47.7	46.2	44.6	43.0	41.5	[illegible]
56	55.8	55.4	54.6	53.6	52.4	51.0	49.5	47.9	46.3	44.6	43.0	[illegible]
58	57.8	57.3	56.6	55.5	54.2	52.8	51.2	49.6	47.9	46.2	44.6	[illegible]
60	59.8	59.3	58.5	57.4	56.1	54.6	53.0	51.3	49.6	47.8	46.1	[illegible]

Continued on Page 42

TABLE T-5, CONTINUED

Topographic Abney and 1-chain (100 links) taps

Slope distance in links	TOPOGRAPHIC											
	5	10	15	20	25	30	35	40	45	50	55	60
62	61.8	61.3	60.5	59.3	58.0	56.4	54.8	53.0	51.2	49.4	47.6	45.9
64	63.8	63.3	62.4	61.2	59.9	58.3	56.5	54.7	52.9	51.0	49.2	47.4
66	65.8	65.3	64.4	63.2	61.7	60.1	58.3	56.4	54.5	52.6	50.7	48.8
68	67.8	67.2	66.3	65.1	63.6	61.9	60.1	58.1	56.2	54.2	52.2	50.3
70	69.8	69.2	68.3	67.0	65.5	63.7	61.8	59.9	57.8	55.8	53.8	51.8
72	71.8	71.2	70.2	68.9	67.3	65.5	63.6	61.6	59.5	57.4	55.3	53.3
74	73.8	73.2	72.2	70.8	69.2	67.4	65.4	63.3	61.1	59.0	56.8	54.8
76	75.8	75.1	74.1	72.7	71.1	69.2	67.1	65.0	62.8	60.6	58.4	56.2
78	77.8	77.1	76.1	74.6	72.9	71.0	68.9	66.7	64.4	62.2	59.9	57.7
80	79.8	79.1	78.0	76.6	74.8	72.8	70.7	68.4	66.1	63.8	61.5	59.2
82	81.8	81.1	80.0	78.5	76.7	74.6	72.4	70.1	67.8	65.4	63.0	60.7
84	83.8	83.1	81.9	80.4	78.6	76.5	74.2	71.8	69.4	67.0	64.5	62.2
86	85.8	85.0	83.9	82.3	80.4	78.3	76.0	73.5	71.1	68.5	66.1	63.6
88	87.7	87.0	85.8	84.2	82.3	80.1	77.7	75.3	72.7	70.1	67.6	65.1
90	89.7	89.0	87.8	86.1	84.2	81.9	79.5	77.0	74.4	71.7	69.1	66.6
92	91.7	91.0	89.7	88.0	86.0	83.8	81.3	78.7	76.0	73.3	70.7	68.1
94	93.7	92.9	91.7	90.0	87.9	85.6	83.0	80.4	77.7	74.9	72.2	69.6
96	95.7	94.9	93.6	91.9	89.8	87.4	84.8	82.1	79.3	76.5	73.7	71.0
98	97.7	96.9	95.6	93.8	91.6	89.2	86.6	83.8	81.0	78.1	75.3	72.5
100	99.7	98.9	97.5	95.7	93.5	91.0	88.3	85.5	82.6	79.7	76.8	74.0

NOTE: Above table taken from "The Abney Level Handbook", by F. A. Calkins and J. B. Yule.

TABLE T-6

FOR USE WITH TOPOGRAPHIC ALIDADE

DIFFERENCES BETWEEN SLOPE AND HORIZONTAL DISTANCES

Slope in Topographic Units	Slope Distance in Links or in Tenths of a Tape Length								
	250 Links* 10/10	50 Links 2/10	75 Links 3/10	100 Links 4/10	125 Links 5/10	150 Links 6/10	175 Links 7/10	200 Links 8/10	225 Links 9/10
	Differences in Links								
5°	1	0	0	0	0	1	1	1	1
7.5	2	0	1	1	1	1	1	2	2
10°	3	1	1	1	1	2	2	2	3
12.5	4	1	1	2	2	2	3	3	4
15°	6	1	2	2	3	4	4	5	5
17.5	8	2	2	3	4	5	6	6	7
20°	11	2	3	4	5	7	7	9	10
22.5	13	3	4	5	6	8	9	10	12
25°	16	3	5	6	8	10	11	13	14
27.5	19	4	6	8	9	11	13	15	17
30°	22	4	7	9	11	13	15	18	20
32.5	26	5	8	10	13	16	18	21	23
35°	29	6	9	12	14	17	20	23	26
37.5	33	7	10	13	16	20	23	26	30
40	36	7	11	14	18	22	25	29	32
42.5	40	8	12	16	20	24	28	32	36
45°	43	9	13	17	21	26	30	34	39
47.5	47	9	14	19	23	28	33	38	42
50°	51	10	15	20	25	31	36	41	46
52.5	54	11	16	22	27	32	38	43	49
55°	58	12	17	23	29	35	41	46	52
57.5	62	12	19	25	31	37	43	50	56
60°	65	13	19	26	32	39	45	52	58
62.5	68	14	20	27	34	41	48	54	61
65°	72	14	22	29	36	43	50	58	65
67.5	75	15	22	30	37	45	52	60	67
70°	77	16	23	31	39	47	55	62	70
72.5	82	16	25	33	41	49	57	66	74
75°	85	17	25	34	42	51	59	68	76
77.5	88	18	26	35	44	53	62	70	79
80°	91	18	27	36	45	55	64	73	82
82.5	94	19	28	38	47	56	66	75	85
85°	97	19	29	39	48	58	68	78	87
87.5	99	20	30	40	49	59	69	79	89
90°	102	20	31	41	51	61	71	82	92
92.5	105	21	31	42	52	63	73	84	94
95°	107	21	32	43	53	64	75	86	96
97.5	110	22	33	44	55	66	77	88	99
100°	112	22	34	45	56	67	78	90	101

* For 25 links (1/10 of tape length) point off one place to left the values in this column.

TABLE T-7

FOR USE WITH TOPOGRAPHIC ALIDADE

HORIZONTAL EQUIVALENTS OF DISTANCES MEASURED ON SLOPES

Slope in Topographic Units	Slope Distance in Links or in Tenths of a Tape Length									
	250 Links * 10/10		50 Links 2/10	75 Links 3/10	100 Links 4/10	125 Links 5/10	150 Links 6/10	175 Links 7/10	200 Links 8/10	225 Links 9/10
	Links = Feet		Horizontal Equivalents in Links							
5.	249	164	50	75	100	125	149	174	199	224
7.5	248	164	50	74	99	124	149	174	198	223
10.	247	163	49	74	99	124	148	173	198	222
12.5	246	162	49	74	98	123	148	172	197	221
15.	244	161	49	73	98	122	146	171	195	220
17.5	242	160	48	73	97	121	145	169	194	218
20.	239	158	48	72	96	120	143	167	191	215
22.5	237	156	47	71	95	119	142	166	190	213
25.	234	154	47	70	94	117	140	164	187	211
27.5	231	152	46	69	92	116	139	162	185	208
30.	228	150	46	68	91	114	137	160	182	205
32.5	224	148	45	67	90	112	134	157	179	202
35.	221	146	44	66	88	111	133	155	177	199
37.5	217	143	43	65	87	109	130	152	174	195
40.	214	141	43	64	86	107	128	150	171	193
42.5	210	139	42	63	84	105	126	147	168	189
45.	207	137	41	62	83	104	124	145	166	186
47.5	203	134	41	61	81	102	122	142	162	183
50.	199	131	40	60	80	100	119	139	159	179
52.5	196	129	39	59	78	98	118	137	157	176
55.	192	127	38	58	77	96	115	134	154	173
57.5	188	124	38	56	75	94	113	132	150	169
60.	185	122	37	56	74	93	111	130	148	167
62.5	182	120	36	55	73	91	109	127	146	164
65.	178	118	36	53	71	89	107	125	142	160
67.5	175	116	35	53	70	88	105	123	140	158
70.	172	114	34	52	69	86	103	120	138	155
72.5	168	111	34	50	67	84	101	118	134	151
75.	165	109	33	50	66	83	99	116	132	149
77.5	162	107	32	49	65	81	97	113	130	146
80.	159	105	32	48	64	80	95	111	127	143
82.5	156	103	31	47	62	78	94	109	125	140
85.	153	101	31	46	61	77	92	107	122	138
87.5	151	100	30	45	60	76	91	106	121	136
90.	148	98	30	44	59	74	89	104	118	133
92.5	145	96	29	44	58	73	87	102	116	131
95.	143	94	29	43	57	72	86	100	114	129
97.5	140	92	28	42	56	70	84	98	112	126
100.	138	91	28	41	55	69	83	97	110	124

* For 25 links (1/10 of tape length) point off one place to left the values in this column.

ESTABLISHING BASE LINES BY ROAD TRAVERSE

A deviation from the standard method of conducting surveys from control lines established around square mile units was devised in West Virginia in 1942 and has been used in that State, as well as in Kentucky, to good advantage. Special conditions which were found to exist in West Virginia brought about the modifications of the survey system and in many instances it has been found that much time has been saved through application of the modified system. However, it is doubtful if the system could be used to best advantage throughout the entire region due to varying conditions which are encountered in many of the States comprizing the region.

In West Virginia, much of the white pine growth is confined to areas extending back short distances from the streams and the patternoof growth is definitely of a "finger-like" nature. Usually, the main streams are paralleled by roads, and the modified survey system is conducted from base lines which are established with compass and chain along the roads. At ten-chain intervals (cardinal directions) strip markers are established and permanently marked by banding trees, stakes or posts with a single band of yellow paint. Since all West Virginia pine surveys are conducted on a 2-1/2 % strip sampling basis, eight strip markers are established along each mile of traverse in each grid. The northernmost strip in a grid always bears the number one if the base line survey runs in a northerly-southerly direction, and the southernmost grid bears the number eight. Due to the fact that the greater part of the State's road system runs in a northerly-southerly direction, base lines usually are run in that direction and mapping is accomplished from the established markers in an east-west direction. Occasionally, however, it is more convenient to establish road traverse in an east-west general direction and in this event mapping is accomplished north and south, with the westernmost strip in each grid bearing the letter "A" rather than "one" as in the other case. Thus, the strip markers would carry the letters "A" through "H", the latter being the easternmost strip of the grid.

As the traverse survey is made in the field it is necessary to plot in each shot as it is made so that strip points can be ascertained and marked on the spot. Each so-called strip point is designated by the number of the strip, whether it be one to eight or A to H (depending upon whether the mapping is to be accomplished easterly-westerly or northerly-southerly). Also, markings to indicate the grid within which the strip point falls is desirable. Thus, each strip marker is permanently marked with (1) a single, narrow band of yellow paint, immediately below which is lettered (2) the grid within which the marker falls, followed by (3) the number of the strip. In addition, it is important to permanently mark those points where the base line survey crosses from one grid into another. Such points are

designated with a double band of yellow paint, below which and on the proper sides will be found the numbers of the two grids involved. In cases where the road traverse passes near to a grid corner in ribes areas, corners are located and indicated with three bands of yellow paint, with the proper designation of the four grids involved.

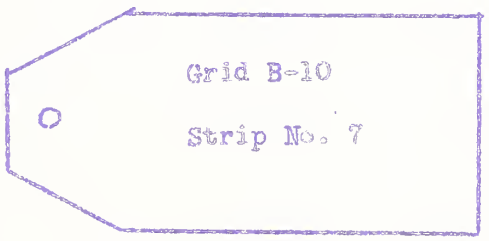
The entire State of West Virginia has been covered by Geological survey and a complete set of quadrangle maps on a standard scale of 1 to 62,500 is available (about one inch equals one mile). In applying the modified "road base line" system in that State the quadrangle maps are gridded in square mile units, and each grid upon which it is desirable to conduct a survey is enlarged to an exact scale of eight inches equals one mile. This enlarging process is accomplished by the use of a projecting machine and a high, glass-topped table with a device which permits height adjustment. The projector sells under the trade name of "Jectascope" and is manufactured by the Federal Stamping and Engineering Corporation of Brooklyn, New York. The prewar cost of the machine was $1.59. Incidentally, projections are made in true colors with this small, practical machine.

It is not absolutely essential that the enlargements be made prior to conducting the survey, but if an accurate base map is available enlargements to our standard scale is extremely helpful and provides a ready check as to the accuracy of the survey as it is actually performed. In Kentucky, the road traverse system has been successfully followed using Forest Service base maps available for the various Ranger Districts.

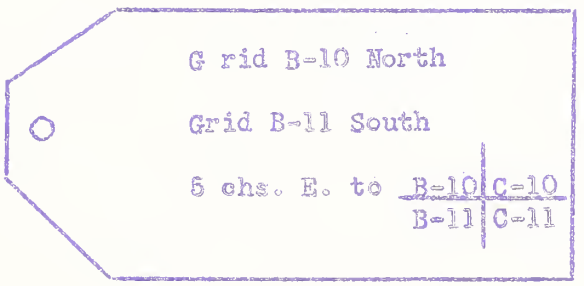
There are two advantages to be had in this modified system of survey. In the first place, it eliminates the necessity of establishing so much control line, which is a time consuming process. For example, by studying the illustration given on page 49, it will be seen that, in this particular instance, it was necessary to establish slightly less than five miles of road base line from which the survey was conducted. It is estimated that at least 20 miles of grid line control survey would have been necessary to accomplish the survey using the straight grid system. Advantage number two is to be had in the ease with which the various markers can be found for future reference. For example, using again the illustration on page 49, it is noted that 32 strip points have been marked along the five mile course. In addition, eight grid crossings have been marked, giving a total of 40 markers for future references. Even though it is granted that some of these markers will disappear over a period of years, it is extremely probable that a sufficient number will remain intact to enable ease of location within five to ten years after the survey has been established. Care should always be exercised in placing the markers at places where future interference will be least. For example, it would be better to use a small tree of little or no commercial value upon which to place a marker than to use a large sound tree which might be marketed, thus destroying the marker. Also, the markers should be placed slightly back from the road right-of-way, which might be cleared from time to time.

Road base lines can be established by a two man crew at an average rate of 3 to 4 miles per 8 hour day. The rate at which a crew can lay down base line is dependant to a large degree on the straightness of the road being surveyed. Where long shots can be taken, as much as 5 miles can be established in a single day. The organization of a base line crew varies somewhat from the ordinary unit which is engaged to survey straight, grid-boundary control lines. The compassman acts also as the rear chainman and the note recorder. The head chainman acts as an advance man, stationing himself at strategic points along the road (especially in turns) so that a maximum of distances can be secured on each shot. He also hangs tags indicating the location of the various strip points and grid crossings as the course is plotted in by the compassman, who informs the head chainman where, along the tape, the strip points or grid crossings occur. The usual procedure is to, first, hang tags at the various points, and towards the end of the work-day to permanently mark the points with paint.

TAG USED TO DESIGNATE STRIP POINTS



TAG USED TO DESIGNATE GRID CROSSING



See illustrations of road base line survey on pages 49 and 50.

The mapping crew (usually consisting of two men) begin their type lines from the previously designated strip markers and extend mapping lines as far back as is needed in order to reach the outer limits of the pine area, or, in some cases they continue their line to tie-in points along base lines which have been established along a road in another watershed. If the pine does not extend back from the road too far, as in the illustration on page 49, the mappers offset ten chains when the outer limits of pine have been reached and turn back, tieing in with the correct strip marker when they again reach the base line. Since the mappers carry the eight inch to the mile enlargements, they consult their maps at frequent intervals and correct any errors which might occur in pacing. For example, the distance between the base line and various streams or ridges can easily be determined from the map, and the distances obtained by pacing is adjusted, in those cases where the adjustment is necessary.

All in all, the mapping process is essentially the same as in the straight grid system. Whether or not the mappers run complete strips between two established base lines or conduct a "watershed" survey from a single base line depends upon the width to which the pine area extends back from the various streams. Parallel base lines, however, at intervals of not more than two or three miles apart, are usually possible, and it is wise to establish them, especially in ribes territory. It is not essential that base lines follow roads or trails and occasionally they are established along streams or spur ridges.

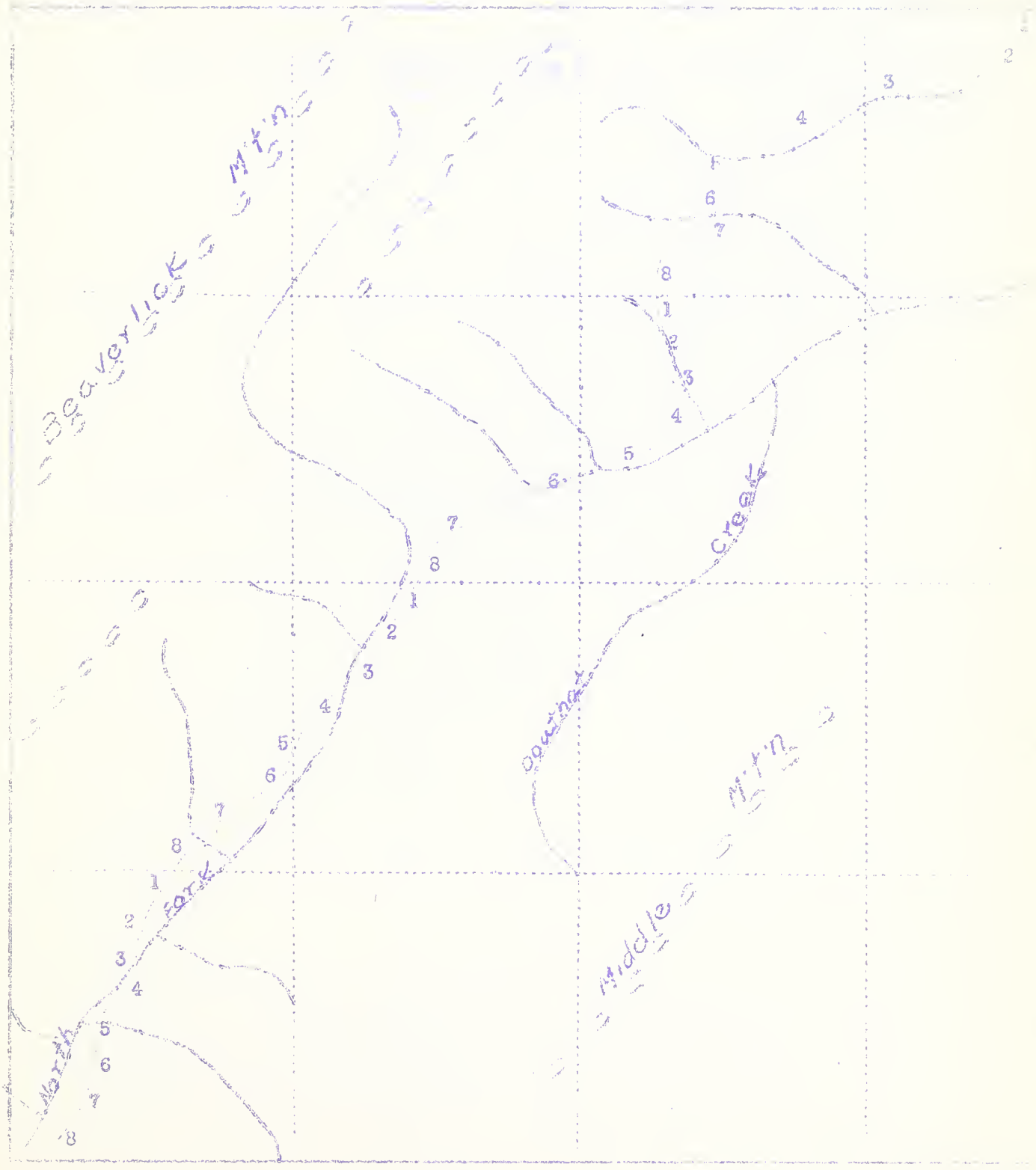
As previously indicated, the base line system as used in West Virginia and Kentucky might not prove at all practical in other States within the region. On the other hand, it might be used to speed up the work in certain sections where streams and roads follow definite parallel trends of direction, where white pine growth occurs in finger-like fashion along the streams, and wher e a good base map is available.

Section of Block No. [illegible] Pocahontas County, West Virginia
Showing Road Traverse Lines From Which Survey Was Conducted

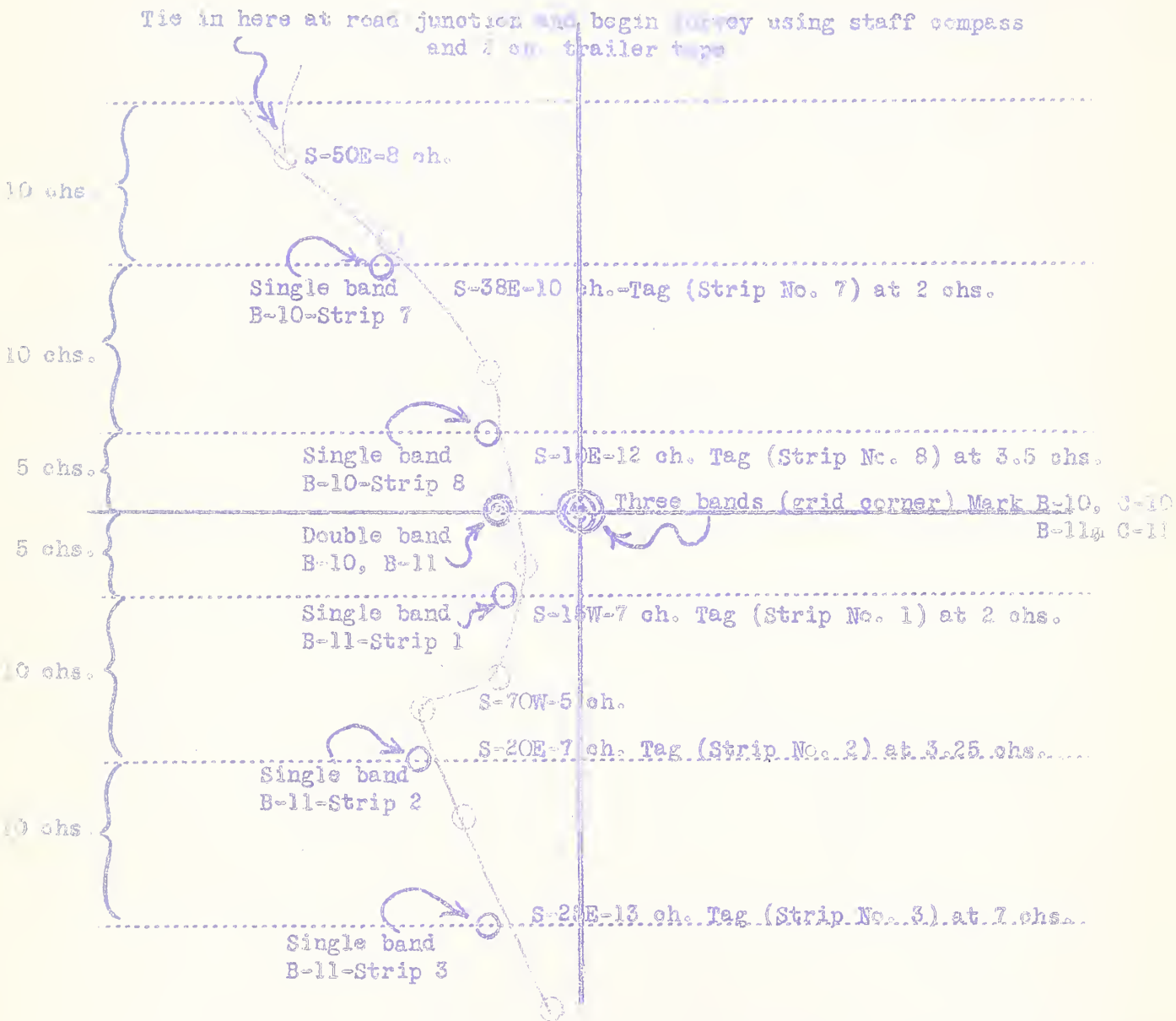
LEGEND:

Stream - - - - - White Pine

Ridges ~ ~ ~ Road _____ (. indicates established strip markers)



P.W.W. 4/1/46



Survey began at road junction in B-10. Compass bearings and distance between each station is shown. Also, the chainage is shown at which points strip markers are established. Note that the horizontal distance between each strip is 10 chains, although the measured road distance is greater. Each shot is plotted in as taken. Grid crossings, as well as strip points are tagged. Also, a grid corner is located by chaining east 5 chs. from the grid crossing

CONTROL ESTABLISHED FROM PLANIMETRIC MAPS MADE FROM AERIAL PHOTOGRAPHS

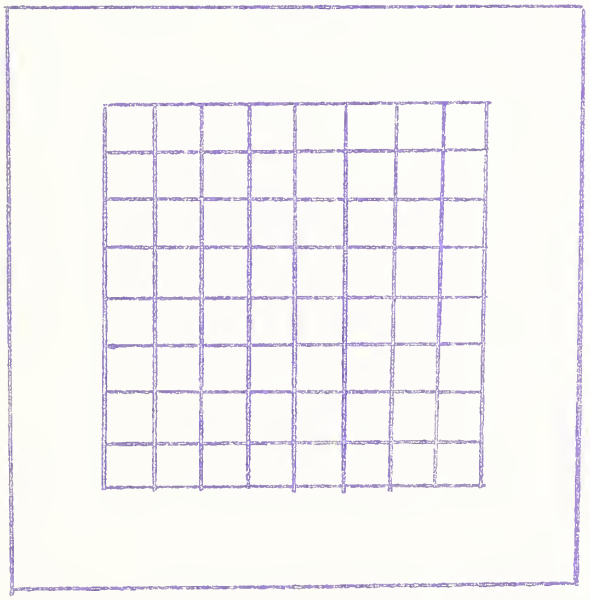
Part II - Survey

When an accurate map is available on which enough control points can be located in the field it is usually not necessary to establish permanent control lines on the ground. When control lines can be liminated, from one-third to one-half or more of the total survey time can be saved. This method is recommended only in ribes-free areas where there is a general misture of open and wooded land or frequent roads or trails. The steps in this procedure are as follows:

1. Overlay the planimetric or similar maps with the basic grid system, using whatever base has been established.

2. From a reconnaisance survey or other information, determine what grids contain white pine worth mapping.

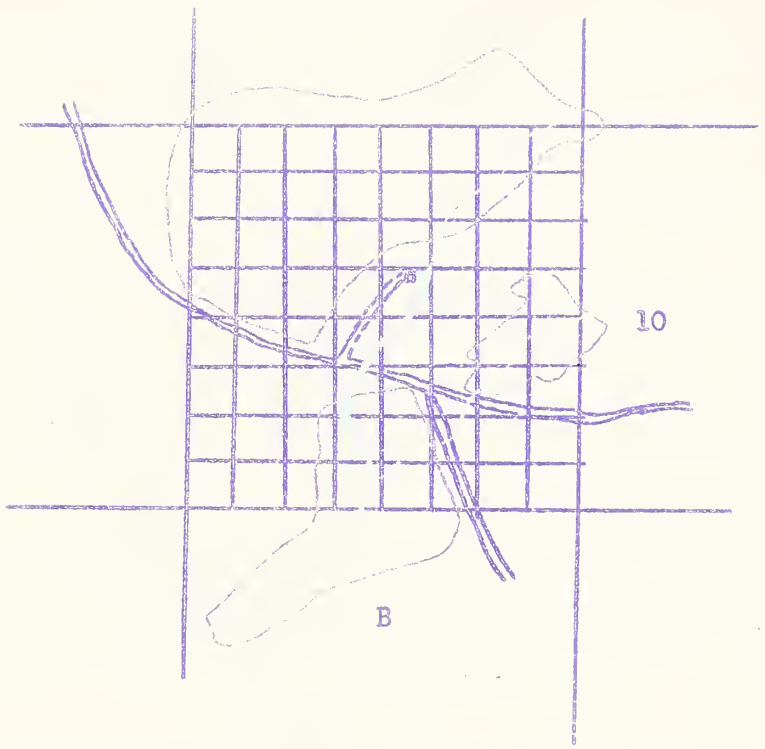
3. Enlarge each grid to be mapped to 8" = 1 mile, using Form EQ-435, showing essential topographical and cultural features. This can be done with a pantagraph, proportional divider or projector, as described on page 46. If neither are available it can be done by occular estimate as follows: using any sharp steel point, draw the outline of a grid on a piece of celluloid and subdivide this grid into sixty-four equal size squares. Each line on the celluloid will equal a heavy dotted line on the Form EQ-435. The size of this outline on the celluloid will vary according to the scale of the map. The following diagram shows the celluloid:



A margin of about 1/2" is provided for convenience in using. The 2" inner square represents one grid (for a map of this scale only). The distance between the inner lines is one-eighth of the grid and can be determined by measurement or the use of dividers.

In enlarging the map the celluloid is placed over a grid and, using the lines as a guide, the essential features are sketched on the Form EQ-435. The essential features are roads, trails, fields, streams, railroads, power lines, etc. This is regarded as a base map and is carried into the field by the mapper.

4. The mapping procedure is essentially the same as for regular grid mapping, except as follows: instead of the mapping lines beginning at a tag or stake and ending at another one, they begin at corresponding points as determined from control points on the base map. The lines and the 5 chain transects should be shows the same as in a regular grid survey. The following example shows the procedure described:



For instance strip 1 would begin at the road 34 chains west of where it crosses the larger stream and would run due north 38 chains where a tag would be hung, in the same manner as if a control crew had established that point. The mapper would then offset 5 chains to the east (if he were running a 5% survey) and map due south to the road a distance of 41 chains, and continue in the same manner until all of the woods in the northern part of the grid is mapped. If white pine is present in the small wooded area in the east-central part of the grid, it could be mapped as follows: starting at the point where the small stream crosses the road, a line can be run north 35 degrees east to the edge of the woods, or a distance of 27 chains. The mapper could then offset along the edge of the woods for a distance of 6 chains, which would place him on the grid line, and run a reasonable sample of that particular wooded area. The wooded area in the south side of the grid could be mapped as follows: beginning at the road intersection, run due south 25 chains and hang a tag in the same manner as the first one described in the northwest corner of the grid. He would then offset west 5 or 10 chains, depending upon the percentage of survey, and run north to the edge of the woods and so continue until this wooded area is mapped. When the adjoining grids are mapped the mapper should tie into the tags which are hung, if at all practical. If, on the attached grid, ribes were present, a location marker should be placed on the east and west sides of the grid along the road. In ribes-free country the markers would be placed similarly, except that it would not be highly important that every line be marked.

Form EQ-435

UNITED STATES DEPARTMENT OF AGRICULTURE

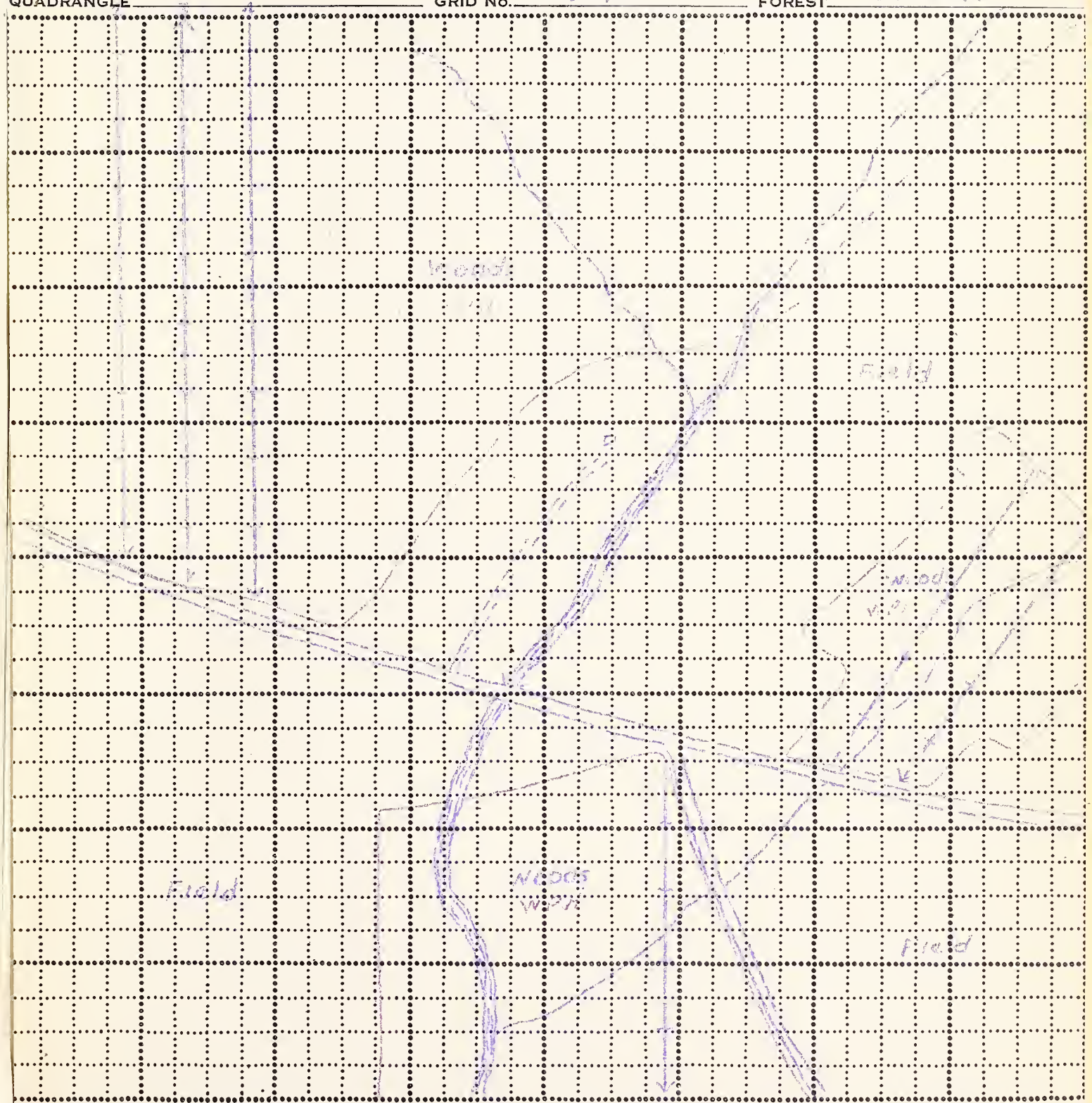
BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

STATE Virginia COUNTY Rockingham SEC. Dist 10 (Township, section, or subdivision) T _____ R _____

AREA Runions Gap (Name or number) MAG. DECL. 4° W SCALE 8" = 1 mile

ACRES IN CONTROL AREA 640 ACRES OF PINE TO BE PROTECTED 330

QUADRANGLE _____ GRID No. B-10 FOREST Pittsburg



FIELD WORK BY Yost PLATTED BY Cramer DATE 3/27/43

REMARKS: Logged ——— Woodland Boundary
Map Strips

8—13142 U. S. GOVERNMENT PRINTING OFFICE

PART III

WHITE PINE MAPPING AND CHECKING

I N D E X

PAGE NO.

CHECKING:

PAGE NO.

WHITE PINE MAPPING AND CHECKING

INTRODUCTION

Because the methods and procedures of conducting white pine surveys and checking are about identical, we have treated them as one subject as far as the mechanics of the operation goes.

Both white pine survey and checking may be defined as a method whereby the Ribes and white pine population of an area are sampled in order to determine the number of white pine stems, Ribes and feet of live stem and their distribution.

White pine surveys can be conducted in conjunction with advance or post checking or performed as a separate operation.

COMPASS AND PACING

The Forestry Compass

The essential parts of this compass and their respective functions are: A magnetic needle that points to magnetic north and from which true north is determined, a graduated circle for laying off angles from true north, and a sighting line for prolonging a line of sight.

Directions in blister rust control work are ascertained with reference to true north. The compass needle always points toward magnetic north. The difference between true north and magnetic north is called the magnetic declination, or simply the declination, and it varies from 9° west to 2° east in the Southern Appalachian Region. By using the correct declination on the compass the sighting line will point to true north when the north end of the needle points to the "0" on the graduated circle. The theory of magnetic declination is illustrated in Figure 1. The declination within a blister rust control unit is considered to be constant, therefore once the proper angle is set off on the compass it need not be changed as long as the compass is being used in that unit.

The counterbalance (a coil of fine wire) on the south end of the needle is to compensate for the downward pull of the earth's magneticsm on the north end of the needle. The north end of the needle is usually marked with a small arrow.

The letters "E" and "W" are interchanged on the compass plate in order that the direction of the line of sight is indicated on the graduated circle by the north end of the needle.

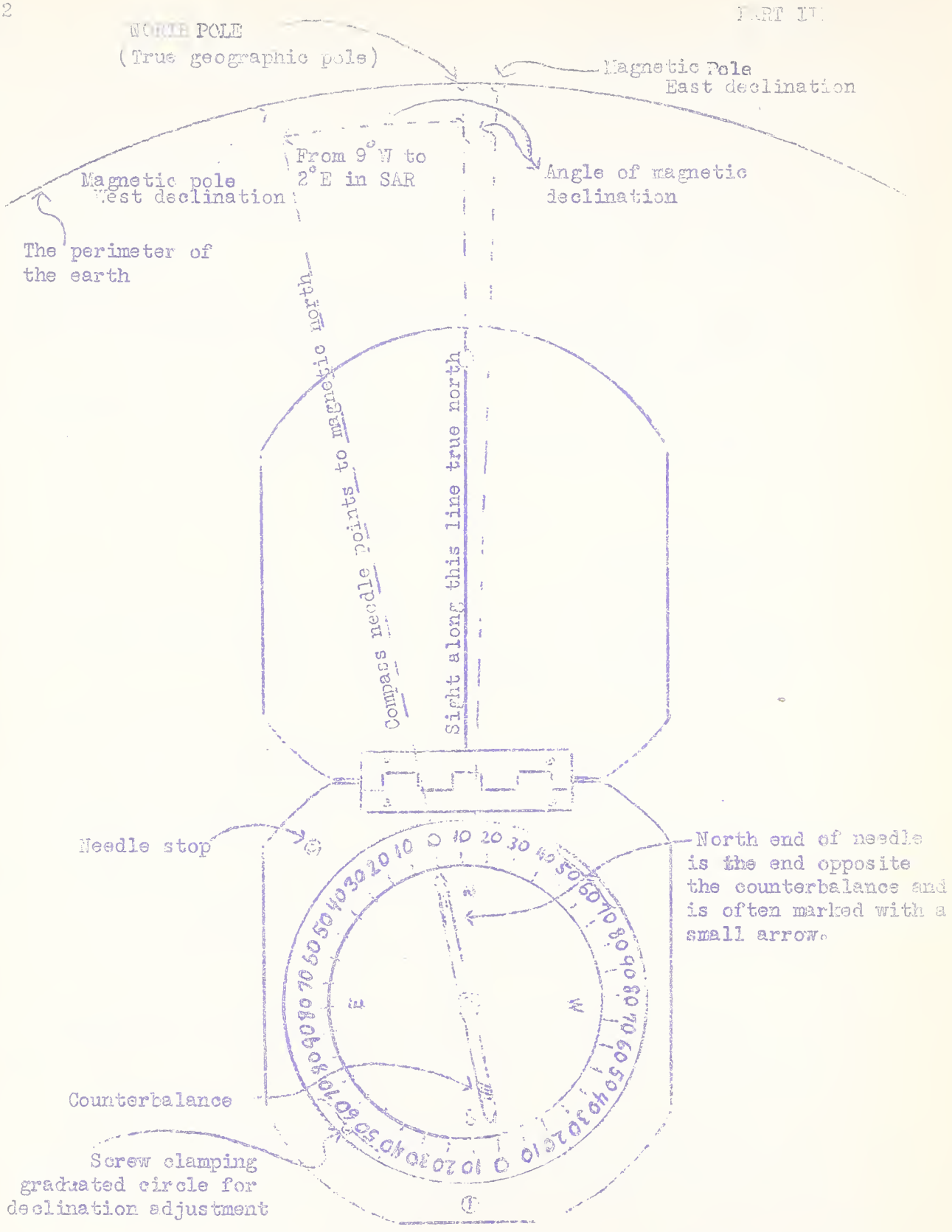


Figure 1 - Magnetic Declination and the Compass

PAGE 3

How to Use the Compass:

The proper way to stand while using the compass is illustrated in Figures II and III below:

FIGURE II: Holding the Compass. Hold the compass in both hands with the elbows firmly against the sides and with your weight evenly distributed on both feet.

FIGURE III: Prolonging the line of sight. Look along the sighting line and then raise your eyes to prolong the line of sight ahead. Do not move your head; raise your eyes.

The steps to be followed in using the compass, after the correct declination has been set off, are:

1. Stand over the starting point and face in the direction that the line of sight is expected to take. For example, if the course of the line being followed is due south, face as nearly south as possible before opening the compass and freeing the needle.

2. Hold the compass in both hands with the left thumb over the needle stop and the elbows held firmly against the sides of the body.

3. Hold the compass level while either a direction is being determined or a line of sight is being prolonged.

4. Throughout the entire reading and sighting operation the compass should remain motionless and in such position that a vertical plane passed through the sighting line would also pass midway between the eyes of the compassman.

5. In bringing the north end of the needle to the desired position on the graduated circle the entire body should be swung around slowly and the feet should be moved if necessary to keep the body facing the line of sight. Stand with your weight evenly distributed on both feet.

6. Use the needle stop to lessen any excessive swinging of the needle.

7. When the north end of the needle has come to rest at the correct position on the graduated circle look along the sighting line, and then by raising your eyes prolong the line of sight ahead.

8. One or more objects, such as the trunk or limb of a tree, or a rock, should be noted along the line of sight.

9. Close the compass while it is in this position and put it away. This practice prevents injury to the needle and pivot and also saves time when the next sight is taken as it leaves the needle pointing to the bearing of the line being followed.

10. Proceed along the line of sight to the most distant object noted on its course and then take another sight with the compass.

11. Belt buckles, mechanical pencils, or other objects containing iron or steel, if allowed too near the compass while taking a sight will influence the position of the needle.

12. Cautions to be observed in the use of the compass are:

a) Be sure that the correct declination is set off on the compass.

b) When running lines always follow the line of sight and not the direction of the needle.

c) The compass is a delicate instrument; handle it carefully.

d) Always follow the line indicated by the compass rather than relying on your judgement as to its direction.

12. Continued

e) Remember the object (tree or rock, etc.) on the line of sight. When in doubt take another compass reading.

f) Keep articles containing steel or iron sufficiently far away from the needle to avoid influencing it.

g) Do not attempt to adjust or repair the compass except in emergencies. Take it to your supervisor for attention.

Example in the Use of the Compass

The assignment is to run a line due east from a given point. The compassman first examines the compass to see that the proper declination has been set off. He then faces eastward and while holding the compass level moves it slowly until the north end of the needle points to the "90" on the side of the graduated circle marked "E". The compassman then projects the line of sight and notes one or more objects along its course. He closes the compass and proceeds along the line of sight until he reaches the most distant object sighted where another compass sight is necessary. This procedure is repeated until the required distance is covered.

Pacing

Pacing is the measuring of horizontal distance on the earth's surface by counting steps of a known length. With practice a man can attain accuracy sufficient for most field measurements needed in blister rust control work.

The equipment needed in pacing is a tally register for recording the number of paces traveled and a pacing table for converting the number of paces recorded into the equivalent number of chains.

A pace is the distance on level ground between the heel of one foot and the heel of the same foot where it next touches the ground while walking normally; that is, two normal steps. The recorded pace of an individual always represents the same horizontal distance regardless of any ground condition which may influence the length of step.

Because the length of pace varies with the individual it is necessary for each man to learn the length of his normal pace. A pacing course several chains in length should be established on open, level ground with its ends prominently marked. To determine his length of pace a man walks the course recording each pace as it is taken. Starting at one end the tally register (set at "0") in his left hand, the man steps off with his right foot and walks the length of the course. Each time his left foot touches the ground the tally lever is depressed, recording the pace. It is important to walk naturally using steps of normal length as one's pace is more consistent and it is easier to travel through the woods when

one's normal stride. The course should be paced many times until there is almost no variation in the number of paces required. The total number of paces for the course is divided by the length of the course in chains to give the number of paces per chain. A corresponding pacing table is selected or prepared for ready conversion of paces to chains.

Other pacing courses established on slopes varying both in steepness and ground cover will give the opportunity to practice accurate pacing under all conditions. Allowances for the factors influencing accuracy of pacing require judgment, practice, and experience. The principal factors influencing the accuracy of pacing are:

1. Steepness of slope effects pacing in two distinct ways.

   a) The natural length of step in walking or climbing up or down varies with the steepness of slope.

   b) The second effect of steepness of slope relates to the fact that land surveys are based on horizontal distances. In order to measure a given horizontal distance; for example, one chain, a man must travel more than one chain when walking on a slope (Figure 4). This is equally true whether going uphill or downhill. The difference between the horizontal distance and the slope distance becomes increasingly pronounced as the steepness of slope increases.

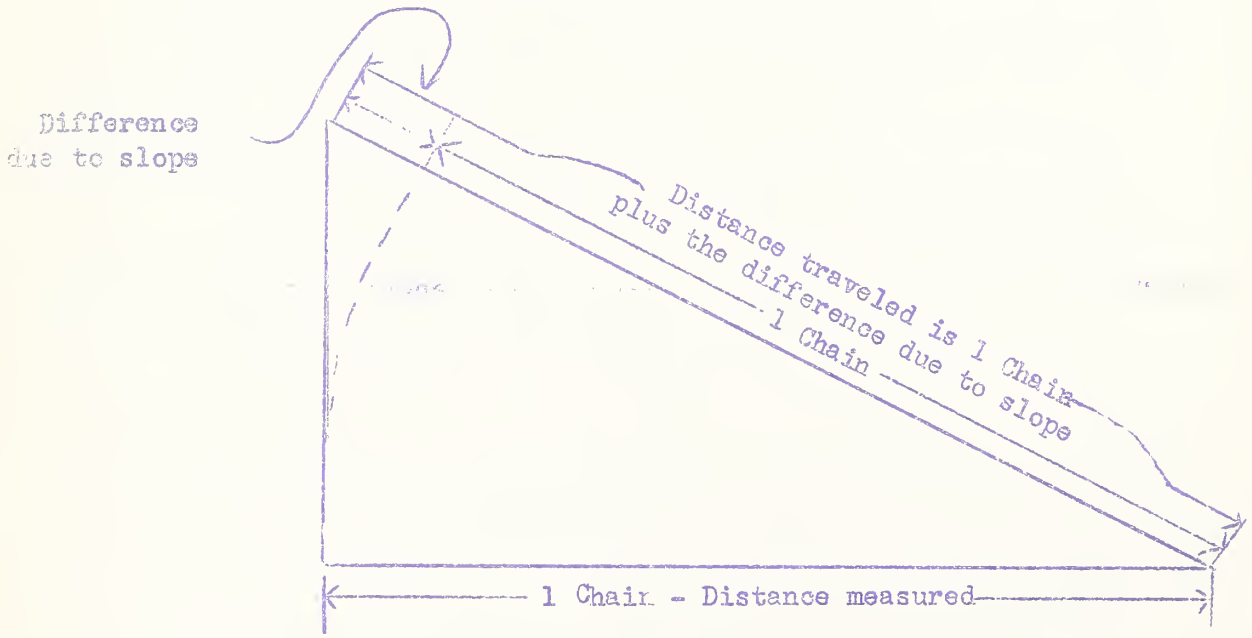


FIGURE 4 - The effect of slope on measuring horizontal distance.

When measuring a grid line (Figure 5), several changes in slope may occur. The distance traveled on the surface in measuring one mile is much greater than the horizontal distance. The allowance for slope or any other factor is usually made as each pace is covered so that the figure recorded on the tally register always indicates the horizontal distance covered. In other words, if a man uses 12 paces to cover a chain on level ground, each pace recorded should equal 1/12 chain horizontal distance measured regardless of slope or any other factor.

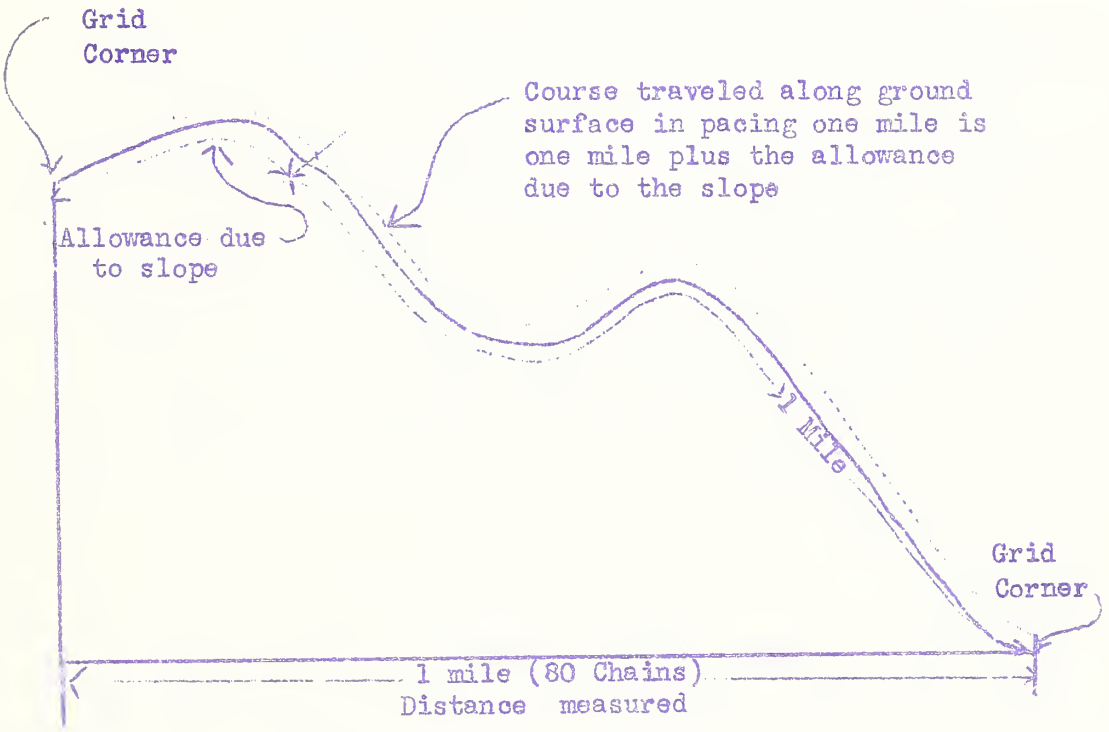


FIGURE 5 - Allowance needed due to slope when pacing a grid line.

The allowances for slope are applied continually as the pacing progresses. The allowance that is needed will vary with the steepness of slope. The extra steps taken to cover the additional distance traveled due to slope are not recorded.

2. Human factors must be considered. A man's vitality may decrease during a day's work. After a poor night's sleep, or with illness, and as a result he is likely to shorten his step. A man's step is shorter when traveling slowly than when moving at his normal rate. On the other hand, he is likely to lengthen his step in the early morning, when he is in a hurry, or on gentle slopes after leaving rough country. All of these factors must be allowed for in pacing.

3. Dense reproduction, brush, greenbriers, or a combination of these conditions increase the effort required for accurate pacing.

4. On loose, rocky, or swampy soils it is more difficult to pace than on firm soil, and allowances must be made for these conditions.

It is desirable to learn to estimate short distances, as occasionally either a stream too deep to wade or a slope too steep to traverse is encountered and the distance must be estimated. Often in rough country or dense brush it is more accurate to estimate a short distance to some object than it is to pace the distance. Men should first practice estimating in units of paces and then increase the estimate to units of chains. In practicing, the estimates should be verified each time by pacing the distance until the desired accuracy is reached. Sample pacing tables are shown on pages

WHITE PINE MAPPING

Pine area mapping may be called the actual survey after preliminary and control surveys are completed. The preliminary survey precedes the mapping crew so only white pine areas are to be included, thus eliminating non pine areas and areas which have already been covered on which adequate maps have been made. The control survey crew surveys out the actual ground control lines within the pine area to be mapped. In any case, good judgement should always be exercised in setting up a survey unit. The greater the area of pine means less cost per acre of pine area covered. Non pine areas should be covered only to the extent of taking in the control zone. An exception to this would be where the survey to be run is in a remote area and the density and extent of white pine and presence of Ribes are not known.

1. The Survey Mapping Crew

The mapping crew will normally consist of two men, a compassman and mapper. The mapper will make actual white pine and Ribes counts on the strips. To make accurate maps and reliable counts, the mapping should be done by a well trained man who shows aptitude for this type of work.

2. Equipment Required for Mapping Crew

1. Tatem holder
2. Hard pencil (preferably 4H)
3. Map form and data sheets
4. Hand compass
5. Tally register
6. Supply of location tags
7. Red pencil for type lines
8. First Aid Kit
9. Snake Bite Kit

3. Procedure for Mapping

Usually
/No less than a 2-1/2 percent estimate will be made. This will normally require 8 strips 10 chains apart per grid unit. The compassman will locate the first 2-1/2 chain stake or tag from the starting corner within the grid to be mapped. If proceeding south, he will take a compass "shot" south from the 2-1/2 chain stake. When he paces out one chain (66 feet) he will call out "chain one". While he is doing this, the mapper will orient himself and start his type line. The width of his strip for recording pine and Ribes data will be 1/4 chain (16½ feet) wide or 8-1/4 feet to either side of him. All data will be recorded by 1-chain transects and summarized at the end of the day by 5-chain transects as described on page 11.

4. The Field Map

The field map, EQ 435 (see page22), is for the purpose of showing graphically the amount and distribution of white pine and Ribes. As the strips are run, type lines are drawn in. Definite cultural features such as streams, roads, trails, main ridges, fields, etc. are also drawn on the map. However, pine and Ribes data are of primary importance and should not be obscured by a maze of topographical and cultural detail.

The heading on the map sheet is to be completely filled out. The map is carried and made in the field. The map is printed on a scale of 8" to the mile and is to be used for one grid unit only. Because certain grids may be slightly irregular the grid control lines are drawn in according to the tie-in of the control survey crew. Before starting to map, the mile strips are lightly penciled in and properly spaced. For the purpose of orientation and summarizing data, points are placed at 5-chain intervals along the strip lines starting at the 2-1/2 chain point. Each strip is numbered to correspond to the strip number in the data sheet and to follow the standard proceedure of strip numbering(see page21).

(a) Timber Types

Timber types will be kept as simple as possible since we are mainly interested in noting the amount and distribution of white pine and Ribes. The standard Forest Service timber type symbols will be used, but used in the broadest sense. If hardwoods, yellow pine and white pine are present with hardwoods predominating, the type will be recorded on the map as (WPH). If yellow pine predominates the type will be recorded on the map as (WPYP). When no white pine is present the type will either be hardwoods (H) or yellow pine (Y). Pure stands of white pine, 50% or better will be typed as (WP). Type lines will be alternate long and short dashes. Since recently cut over areas may effect the type in the future in respect to white pine and Ribes, a cut over type symbol has been included in the legend and is to be used for any area cut over within five years previous to the time of survey. Fields will be typed in with a solid line and designated by the symbol (F). All type symbols and type lines, except cut over type lines and fields will be shown in red as shown on the sample survey map, page 22.

(b) Color Symbols

Showing timber types by the use of colors makes a map easy to read. Too many colors, however are confusing, so colors used should be few with each color having a definite meaning. All types including white pine with 50 trees per acre or more will be colored green. All types showing scattered white pine (less than 50 stems per acre) will be left uncolored. Yellow pine types (no white pine present) will be colored yellow. Hardwood types (no white pine present) will be colored blue. Good white pine worthy of protection will be enclosed by a solid red line.

Since the field map is made in pencil the color symbols are only used on the final survey map. (See page 23).

A legend sheet showing all necessary type symbols, type lines and color symbols is found on page 24.

5. Recording White Pine and Ribes Data:

(a) The Data Sheet

The survey and checking data sheet (see page 25) is divided into fourteen columns. The first column is for the strip number. On the line opposite the strip number give the location of the starting point, the course followed and the date the strip was run.

The second column is for the recording of original 1-chain transects as obtained by pacing. Unless no pine or Ribes are found use only one line to a transect, otherwise consecutive transects are combined, as 8-15, and no data appears on that line.

When the strip is completed, the third column headed "Adjusted 1-chain Transects" is filled out, if necessary, according to the instructions for "the adjustment of errors in pacing". (See page 15).

Column 4 is for recording the feet of live stem, by species, the size of each Ribes bush. Each entry represents one bush; thus, if one bush containing 6 feet of live stem is found on transect 26, it is recorded in the column on the same line opposite the transect number. Columns 5, 6 and 7 are for recording white pine counts by diameter classes by 1-chain transects.

Columns 8 through 13 are for summarizing Ribes and pine data by 5-chain transects. Transects 1 through 5 are recorded in column 8 as (5); transects 6 through 10 as (10), etc. Summaries are only made after the adjustments of error in pacing are made, using the adjusted 1-chain transects column for making the summaries. Ribes and pine data are then summed up by 5-chain transects and recorded. Ribes are summarized by number of bushes over total feet of live stem. White pine is recorded by total number of pine in the 5 1-chain transects involved in the summary by diameter classes and by total white pine.

Record feet of live stem to the nearest foot. Feet of live stem is estimated, although actual measurements should be taken occasionally as a check on the accuracy of estimating. Ribes seedlings should be recorded by using the letter "S".

Taking a portion of an 80 chain strip we have the following example in respect to recording Ribes and white pine data. For a completed record of an 80 chain strip see sample preeradication survey data sheet, page 25.

Adjusted Transect Number	NUMBER RIBES BY F.L.S.	WHITE PINE COUNT			5-CHAIN TRANS. SUMM.						Timber Type
		CLASS "A" 0-4" DBH	CLASS "B" 5-12" DBH	CLASS "C" Over 12" DBH	5-Ch. Transect.	Bu. / F.L.S	White Pine Cl A	Cl B	Cl C	Tot	
1	3,4,10	8	4	3							WPH
2-3											
4	1,2,6	6	2	2							
5	3,	9	2	1	5	7/29	23	8	5	37	
6-8											
9	4,2,7	4	2								
10	2,3	3	1		10	5/18	7	3	0	10	
11-15					15						H
16	10 (30)	3	2	1							WPH
17	8 (42)	10	2	1							
18-20					20	72/636	13	4	2	19	

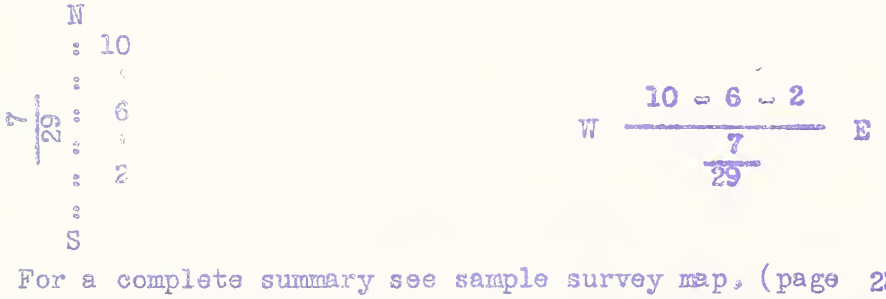
In order to make the [illegible] space has been left [illegible]

Every 1-chain [illegible] a relatively large amount of [illegible], an average F.L.S. figure [illegible] and multiplied by the number of Ribes counted. (See transect 16 and 17 in the table on page 11). In transect 16, the figure 30 represents the average F.L.S. for the (30) bushes counted on the transect. In transect 17, the figure 8 represents the average [illegible] for the (42) bushes counted on the transect. Since transects 16 and 17 fall within the 20th 5-chain transect number the Ribes are summarized as 72 = (30 plus 42) bushes over 636 = (10 x 30 plus 8 x 42) feet of live stem.

After the Ribes and white pine are summarized by 5-chain transects they are plotted on the map sheet. If the strips are run north and south, the number of bushes and feet of live stem are recorded on the west side, like a fraction. White pine counts will be placed on the map by diameter classes. If the lines are run east and west the recordings will be /10-6-2/ the 10 represents W.P. 0-4" DBH and is always to the west in the 5-chain transect. The 6 is 5-12" DBH and is in the center. The 2 is over 12" DBH and is to the east. If running north and south the 10 would be on the north and east side of the 5-chain transect line and followed by the 6 and 2. as:

10
6
2

If strips are run east and west the number of bushes and live stem are placed south of the line, like a fraction. Below is a graphic example of two 5-chain transects; one running north or south and the other east or west to show how ribes and white pine are recorded on the same transect.

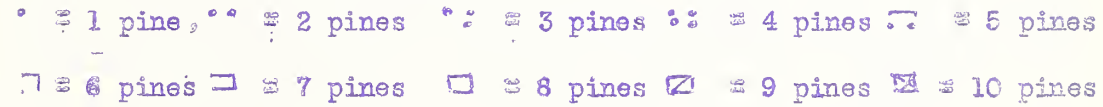


For a complete summary see sample survey map, (page 22.

(b) White Pine Count

White pine counts are taken in three diameter classes. The mapper will always keep in line with the compassman, counting the white pine on either side of him. In order not to miss boarder line trees he

should frequently pace out from the center line 8-1/4 feet as a check on his estimate of strip width. It is advisable for beginners to cut a light pole exactly 8-1/4 feet long to periodically check the strip width until accuracy of estimating the width by eye is attained. In counting white pine, care must be taken not to go too fast since small trees may be overlooked. When large trees are encountered be sure and look up at the crowns. If this is not done a dead tree may be recorded. Do not walk around brush or rocky outcroppings. Both pine and ribes may be overlooked by doing so. There can be several ways to record white pine counts by diameter classes. However, the easiest way is to have the compassman carry the data sheet and after he has reached his one chain mark to stop and record the pine as called out to him by the mapper. Recordings will be done by the dot and dash system which is as follows:



After one block of 10 is completed another block is started. Since it is important that the recordings fall in the proper columns the mapper should call out the class for each group he is estimating. Thus, as he walks along he will call Class A; 1, 1, 1, 1, 1 and for each 1 called the recorder will put down a dot for the first 4 called, (:) and for the fifth one a dash (:—). The mapper then calls Class B, 1, 1, 1 and the recorder using the B column will record (:). In each case the recorder will complete a block of 10 before starting a new block in any one diameter class. The blocks will be recorded at the extreme left of each column. At the end of the transect the dots and dashes will be added up and the total figure will be recorded at the extreme right side of the column:

Transect No	CLASS A 0-4" DBH	CLASS B 5-12" DBH	CLASS C Over 12" DBH
1	13	5	3

For a completed record of an 80 chain strip see sample survey and checking data sheet on page 25.

(c) Ribes Count

Although the looking for and recording Ribes is actually a part of checking, we combine this activity with survey work whenever practicable. Ribes data gathered on surveys should not, however, be relied on too heavily when the survey is performed during the dormant season. In this case likely ribes areas should be reexamined in the spring after the foliage is out. If this is not done there is always the possibility that areas may become classed as ribes-free which may not be actually free after a check is made in the growing season. On the other hand, we can often save time and money where the survey crew actually finds enough Ribes to warrant ribes eradication, thus, eliminating the necessity of running a checker over the same territory at a later date. (Read section on "Checking", page 26).

The recording of Ribes data has already been explained under 5 (a) on page 10.

The mapper should always be on the watch for Ribes. When encountered on his strip he estimates the feet of live stem for each bush and records, in the proper column of the data sheet, the feet of live stem separately for each bush found in the transect. If Ribes are numerous he records the data as explained on page .

Likely places where Ribes may grow should be carefully checked. In some cases it may be necessary to take sample plots off the regular strip course as in a case where a strip parallels a water course, rocky ledge, hollow, etc. Off strip plots are shown recorded and plotted on the sample survey map and survey and checking data sheet, page 25 After off strip plots are taken the mapper continues on the regular strip where he left off. Transect numbers for off set plots are taken separately from regular transect numbers, and should be bracketed in the data sheet with a brief description of plot location opposite the bracket facing the "Strip No." column.

(d) The Interpretation of White Pine and Ribes Data on a Per Acre Basis.

One 5-chain transect 1/4 chain wide equals 0.125 acre ($\frac{5 \text{ chains} \times 1/4 \text{ chain}}{10}$ equals 0.125 acre). Since 0.125 is 1/8 of one acre, to calculate the number of white pine stems on any one 5-chain transect to a per acre basis it is only necessary to multiply the number of stems found within any one 5-chain transect by the figure 8. Since each strip is 1/4 chain wide, the strip acres in each mile run is 2, ($\frac{80 \text{ chains} \times 1/4 \text{ chain}}{10}$ equals 2 acres). Eight, mile long strips therefore equals 16 strip acres or 2-1/2 percent of 640 acres. ($\frac{16 \text{ acres}}{640 \text{ acres}}$ x 100 equals 2.5%).

Estimating 5-chains on either side of the strip we therefore say that in each mile strip (2 strip acres) 80 acres are covered ($\frac{10 \times 80}{10}$ equals 80) or on each 5 chain transect (0.125 acre) 5 acres are covered ($\frac{5 \times 10}{10}$ equals 5 acres). Ten trees therefore found on a 5-chain transect is representative of (8 x 10) or 80 white pine stems per acre on the 5 acres covered. The per acre figures are calculated after the data sheets and map are completed for a grid and the following procedure is to be followed:

(1) To obtain the average number of white pine stems for all pine falling in the type lines representing 50 and over stems per acre the strip acres will be added up for this type and divided into the total number of pines.
Example: It was found that there were 860 white pines recorded on 360 chains run $\frac{360 \times 1/4}{10}$ equal 9 strip acres.

Dividing 860 by the 9 strip acres we have 96 - white pine stems per acre in the 50 and over density class. The same method is used for determining stems per acre for scattered pine.

When Ribes are plotted on the map (Form EQ 435) a brown line is drawn around the Ribes area. This line will indicate to the eradication crews the location of Ribes concentrations. To conform with acres covered on a 2-1/2 percent estimate the brown line will always be carried 5 chains out from the transect or transects on which Ribes are found; thus if Ribes are found on 4 consecutive 5 chain transects and none are found on any of the other strips the Ribes eradication boundary line is shown 5 chains to either side of the transects showing Ribes. Since four 5 chain transects equals 20 chains or 1/2 strip acre ($\frac{20 \times 1/4}{10}$ equals 0.5 acre) the acres to be covered would be 20 ($\frac{20 \times 10}{10}$ equals 20 acres). To estimate the number of Ribes and feet of live stem on a per acre basis for the acres covered, divide the number of bushes and feet of live stem by the strip acres contained within the transect showing Ribes. In the above example if 20 bushes containing 60 feet of live stem were found on the 0.5 strip acre, the estimate on a per acre basis for the 20 acres covered would be 40 bushes per acre and 120 feet of live stem per acre. On a 2-1/2 percent estimate these figures, of course, are only approximate but they will be of considerable aid in making estimates for amount of work to be done by the eradication crews.

(e) The Adjustment of Errors in Pacing

The following explanation is for the purpose of adjusting the misnumbering of transects resulting from errors in pacing.

As it rarely happens that the paced distance between two points coincides with the known or assumed distance, the number of transects recorded for the strip is more or less than the true number by the amount of error in paving. To correct the numbering of transects, the error must be distributed throughout the entire strip, inasmuch as one can seldom say with any certainty where most of the error occurred and as the error is usually cumulative, it is assumed that the distribution be uniform from the beginning to the end of the strip. The method described here has been devised to interpolate or delete the missing or superfluous transects at the proper points throughout the strip. When it is found necessary to make the adjustment the third column headed "Adjusted" in the preeradication survey data sheet, is used. An attempt has been made in the following steps and examples to explain the process of adjusting.

1. Determine the difference in chains, (equivalent to transects) between the paced distance and the true or assumed distance, noting whether in the adjustment it should be added to or subtracted from the paced distance.

2. Divide the paced distance by this difference. Multiples of the quotient represent the points in chains of paced distance at which cumulatively one chain of the error should be dropped or added as the case may be.

3. At the points thus established (or at points nearest them), by adding or subtracting cumulatively one chain of error, correct the paced distance to agree with the true distances that the pacer had reached at that particular point. Example of the first three steps: If the paced distance is 36 chains and the true distance is 40, the error is 4; dividing 36 by 4 gives 9, which means that at every 9 chains one chain is to be added cumulatively thus; the 9th transect becomes the 10th, the 18th becomes the 20th, the 27th becomes the 30th, and the 36th becomes the 40th.

With reference to the foregoing steps the following example illustrates the renumbering of transects to adjust the error in pacing.

Original 4-Chain Transect numbers (as recorded from pacing)

1	-	6
7		
8	-	13
14		
15	-	19
20		
21	-	29
30		
31	-	36

Steps 1 and 2

True or assumed distance	=	40 chains
Paced distance	=	36 chains
Difference	=	4 (40-36)
Quotient	=	9 (36/4)

Set up the table below which is the basis of Step 3

Original transect numbers	Action required	New numbers
1	No change	1
9	Add 1	10
18	Add 2	20
27	Add 3	30
36	Add 4	40

From the original column (applying step 3) the exact points 9, 18 and 27 at which the basic changes occur are not present hence the transects nearest them are considered and corrected as follows:

No change for first transect - - - - - - - - - - - - - - (1)
8 is closest to exact point 9 (add 1) - - - - - - - - - (9)
19 is closest to exact point 18 (add 2) - - - - - - - - (21)
29 is closest to exact point 27 (add 3) - - - - - - - - (32)
36 is same as exact point 36 (add 4) - - - - - - - - - (40)

Correcting remainder of original numbers between exact points:

Original numbers ( )= Numbers corrected as above		Exact points	Action taken	New Number
(1)	= 6	(6 is closest to 9)	Add 1	=7
	7	(7 is closest to 9)	Add 1	8
*(9)	13	(Correct 13 to 18)	Add 2	=15
	14	(14 is closest to 18)	Add 2	16
15	= (21)	(15 is closest to 18)	Add 2	17=
	20	(20 is closest to 18)	Add 2	22
21	= (32)	(21 is closest to 18)	Add 2	23=
	30	(30 is closest to 27)	Add 3	33
31	= (40)	(31 is closest to 27)	Add 3	34=

* In this group original transect number 13 is actually closest to 9 but sinve the sequence must follow from original transect number 15 in the next group, basic reasoning shows that 2 transects must of necessity be added to original transect 13. This will quite often be the case whenever transects fall near the center of an interval between two exact points.

From the above steps and examples the adjusted transect column now becomes:

1	=	7
8		
9	=	15
16		
17	=	22
22		
23	=	32
33		
34	=	40

Although the above example is for the adjustment of 40 chains the same process is applied for adjusting an 80 chain strip. (See adjusted column in sample survey data sheet page 25). With a little practice the whole process can be done mentally in a short time.

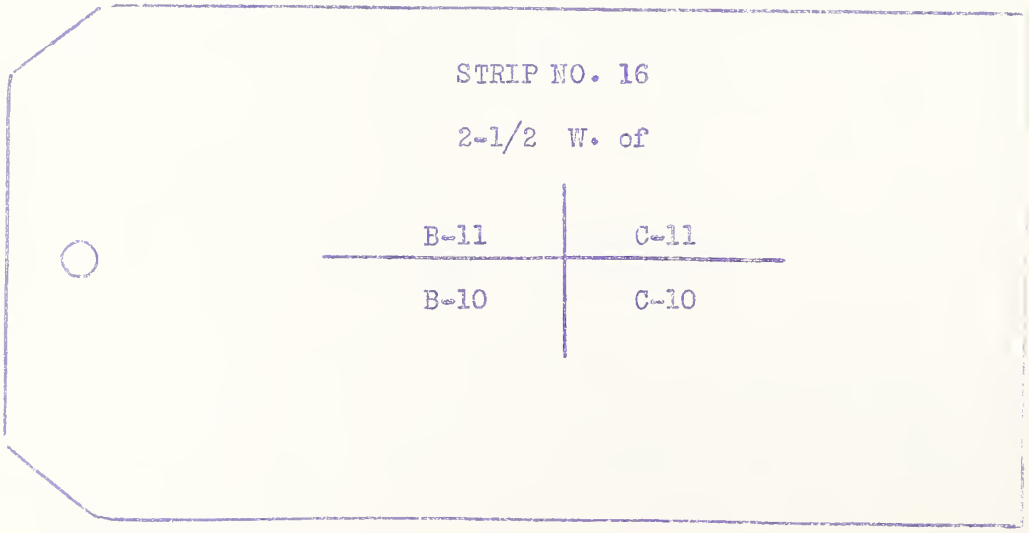
The first paragraph and steps 1, 2 and 3 on the adjustment of errors in pacing have been taken from the 1938 "Checking Manual for Ribes Eradication in California and Oregon". An attempt has been made however, especially in the examples shown, to make the steps more clear to the field man.

TYPES OF WHITE PINE SURVEYS

We have two types of white pine surveys in the Region (1) Preeradication survey, which is a survey on lands which have never been previously covered and (2) Resurveys on lands which we covered five or more years ago. Since over 95 percent of the initial work has been completed in the region we are more concerned with resurveys than preeradications. Our resurveys are important in that they give us the status of white pine as it is today. They also give us a basis for determing priority of working and enables us to delimit ribes-bearing and ribes free lands. The mechanics of conducting preeradication surveys and resurveys are exactly the same.

LOCATION TAGS

These are cardboard tags which are used by the mapping and checking crews to mark the location of their strips. They are to be put up at all road crossings, trail crossings, streams and at tie-in points on grid lines or other designated base lines. The tags will be so marked that they may be used either by a checking crew or a mapping crew. Example: A mapping crew starts out to map grid B-10 in Block 10. The crew locates the northeast corner set by the control survey crew (if no location marker has been set the mapper should put one up at or near the corner - the mapper should always carry a supply of these markers) and paces 2-1/2 chains west to start their first strip. They look for the location tag previously put up by the control survey crew. This tag should read as follows:



The mapper then hangs his tag beside this one which should read:

START STRIP #16 So.
GRID B-10 - Blk. -10
2-1/2 W. of N.E. Corner
Resurvey & 1st Post Check

John Doe 6/7/46

If it is only a resurvey he leaves out "1st Post Check". If he is checking only he leaves out the work "Resurvey". If it is a preeradication survey he writes "Preerad." All types of checks should be designated as "advance" "1st Post Check","2nd Post Check", "1st Regular", "2nd Regular", etc. The explanation of types of checks are found under checking on page

In the above example the mapper, after hanging his tag, proceeds south. At 10 chains he hits a road and puts up another tag which will read:

STRIP No. 16 South.
Grid B-10, Blk. - 10
2-1/2 W; 10 So. of N.E. Corner
Resurvey & 1st Post Check.

John Do 6/7/46

It will be noted that he started on strip No. 16. The reason for this is that all strip numbers originate from the northwest corner of each grid but the chainage is designated from the nearest corner.

The key to strip numbering is illustrated and explained under Checking. However, for all white pine survey work 16 strips will be involved.

When the mapper st[illegible] the south line of the grid he will hang his tag designated as follows:

END STRIP NO. 16 South

GRID B-10, Blk. - 10

3 W of S. E. Corner

Resurvey & 1st Post Check

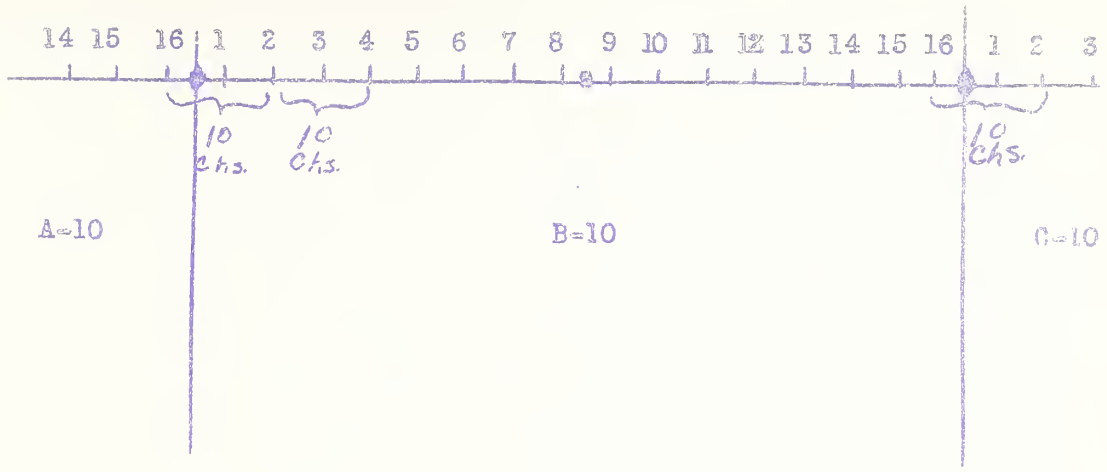
John Doe 6/7/46

When the mapper tied into the south line of grid B-10 he found he was 1/2 chain west of the nearest tag to the S.E. corner hung by the control survey crew which is 2-1/2 chains west of the corner. His line therefore ran only 1/2 chain off course in the 80 chains paced.

If the survey calls for only a 2-1/2 percent estimate the mapper offsets from the 2-1/2 chain mark 10 chains west where he locates the proper control survey tag to start strip No. 14 N. If the tag is missing he assumes that his pacing is correct. However, if tags are set every 2-1/2 chains by the control survey crew he should determine his true position from the nearest tag found to the 12-1/2 chain marker from the S.E. corner. If no tags were set on the south line he, of course, will have to rely entirely on his pacing and correct all errors when he ties into the north line

To complete the 2-1/2 percent estimate, the mapper will then cover strips 16, 14, 12, 10, 8, 6, 4, and 2.

It must be remembered, however, that in order to make a complete uniform coverage so that adjacent grid type lines will tie-in the strip mapped in say grid A-10 to the west of B-10 must also start or finish on strip No. 16. If this is not done the strip will not be uniformly spaced 10 chains apart between one grid andanother. The proper spacing of strips therefore calls for advance planning on the part of the field supervisors. This point is illustrated below:



As the mapper proceeds west when he starts his strip No. 8 going south he will designate his chainage on the tag from the 1/4 corner as illustrated below:

START STRIP 8 So.

GRID B-10, Block 10

2-1/2 W. 1/4 Corner

Resurvey & 1st Post Check.

John Doe 6/10/45

The sample map on page 22 illustrates how strips are run and how the map is built up in the field.

Form EQ-435

UNITED STATES DEPARTMENT OF AGRICULTURE

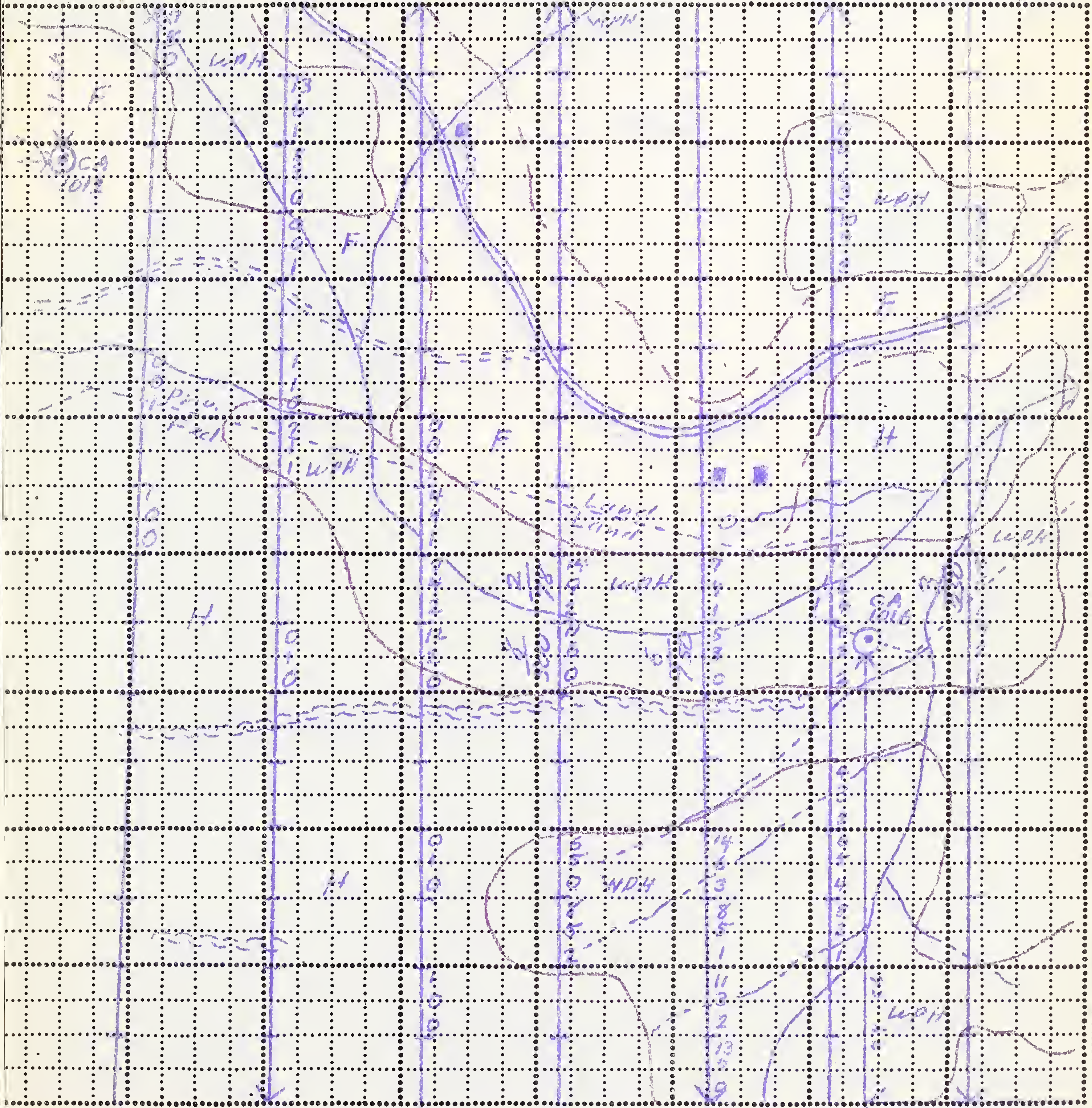
BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

STATE ______ COUNTY ______ SEC. ______ (Township, section, or subdivision) T ______ R ______

AREA Dry River (Gate Run) (Name or number) MAG. DECL. ______ SCALE ______

ACRES IN CONTROL AREA 580 ACRES OF PINE TO BE PROTECTED 176

QUADRANGLE ______ GRID No. N-26 FOREST Geo. Washington

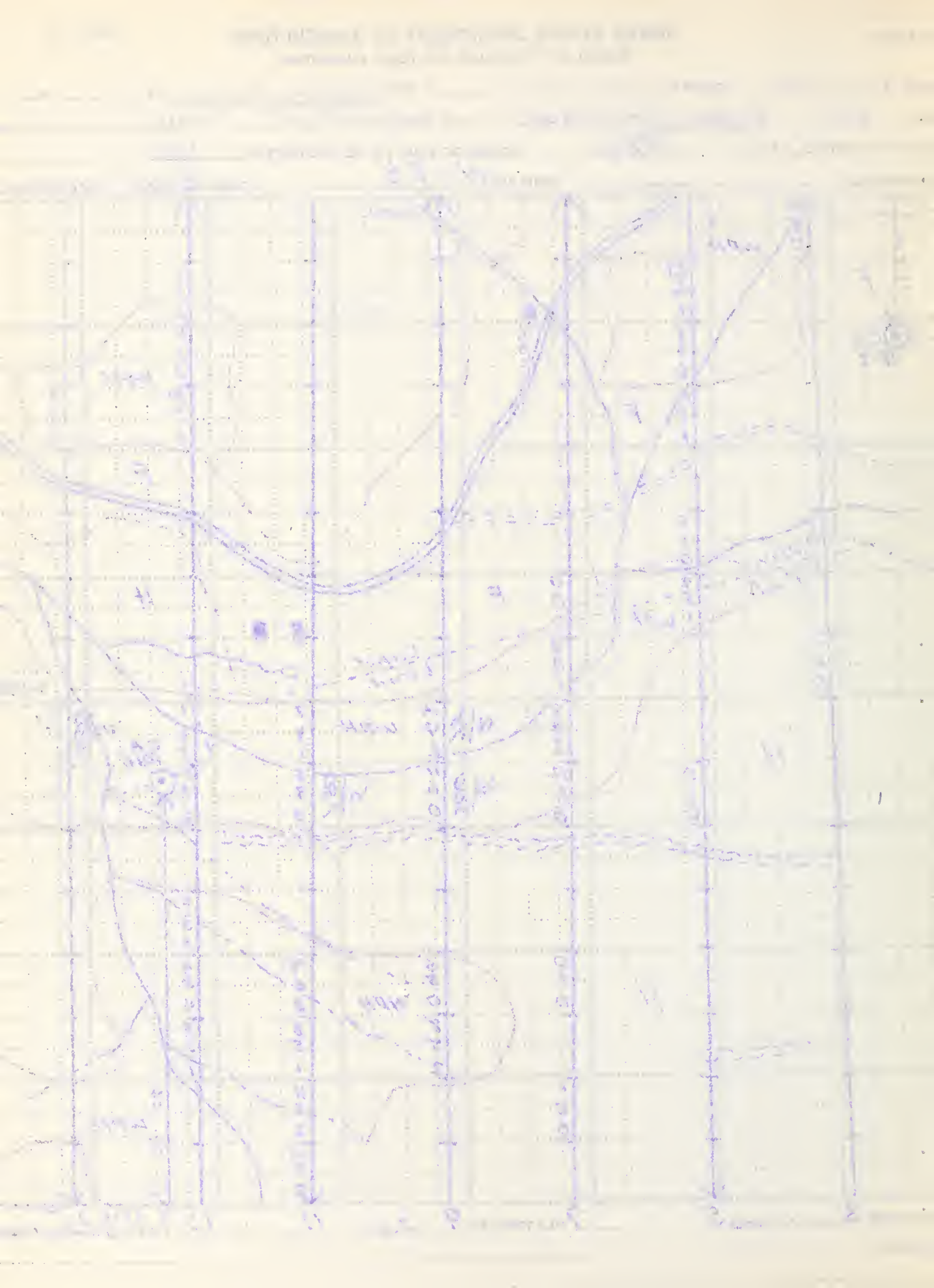


FIELD WORK BY E. L. ______ PLATTED BY T. C. DATE July 1944

REMARKS: ______

RIBES ERADICATION

8—13142 U. S. GOVERNMENT PRINTING OFFICE



Form EQ-435

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

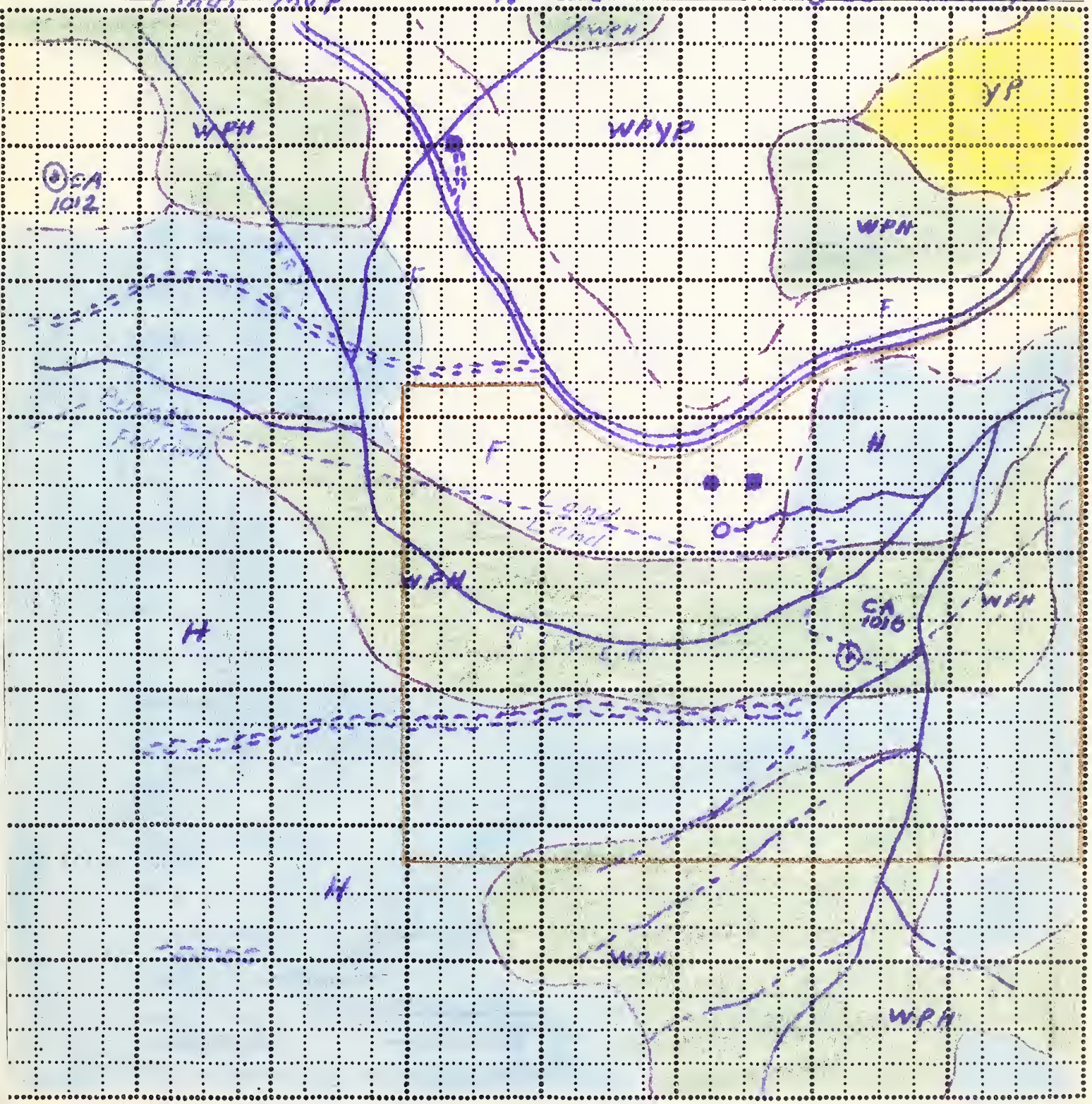
Page 23

STATE Virginia COUNTY Rockingham SEC. Block 8 (Township, section, or subdivision) T R

AREA Dry River (Gate Run) (Name or number) MAG. DECL. 4½° W SCALE 8" = 1 mile

ACRES IN CONTROL AREA 580 ACRES OF PINE TO BE PROTECTED 176

QUADRANGLE Final Map GRID No. V-26 FOREST Geo. Washington



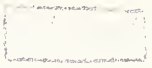
FIELD WORK BY E.L. PLATTED BY J.C. DATE June 1944

REMARKS:

8—13142 U. S. GOVERNMENT PRINTING OFFICE

SYMBOLS USED IN MAPPING AND CHECKING

White Pine Area ..... 


White Pine Plantation

Timber Type Line .....

Recent Cut-Over Type Line .....

Scattered White Pine, either..... Leave Uncolored
in YP or H Types

YP (yellow pine)..... 

no white pine present

White Pine Plantation Site

H (Hardwoods)..... 

no white pine present

Ribes Eradication Area..... 


Re-work Area

Cultivated Field ..... 

Primary Road.....

Nursery

Secondary Road.....

Bridge.....

Trail.....

Mountain Peak.....

Main Ridge.....

Cliff.....

Railroad Used..... Abandoned.....

Telephone Line.....

Fence.....

Buildings.....

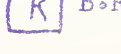
Sawmill Operating..... Abandoned.....

Running Stream..... Ribes Infected

Intermittent Stream..... W. P. Infected

Spring..... Use Blue India Ink

Forest Service Class "A" Corner...



B.R.C. Location Marker

B.R.C. Corner.....

Bench Mark.....

RIBES ERADICATION

AP-4
(REV. 12-17-45)

SURVEY AND CHECKING DATA SHEET

BLOCK NO. 10

STATE: Virginia OWNERSHIP: Fed. & Priv. GRID NO. B-10

COUNTY: Augusta FOR. OR PARK: Geo Wash N.F. AREA NO.

QUADRANGLE: NAME OF AREA: North River

TYPE OF CHECK: 1st Post (ADV. — POST — REGULAR) TYPE OF SURVEY: Re Survey (PRE-ERAD. — RESURVEY)

CHECKER: John Day DATE: 6-4-45 MAPPER: John Day DATE: 6-4-45

STRIP NO.	ORIGINAL TRANSECT NUMBER	ADJUSTED TRANSECT NUMBER	NUMBER RIBES BY F.L.S.	WHITE PINE COUNT CLASS "A" 0-4" DBH	CLASS "B" 5-12" DBH	CLASS "C" OVER 12" DBH	5-CHAIN TRANS. SUMM. 5-CH. TRANSECT	BU. / FLS	WHITE PINE CL. A	CL. B	CL. C	TOT.	TIMBER TYPE
1	Start	Strip # 1 2½ Ch. W of S.E. Cor						Ran N.					
	1-6	1-6					5-10						H
	7	7		2	1								WPH
	8	8	2, 3,	3	1	2							
	9	9	1, 2,	4									
	10	10	4	2		1	10	5/12	11	2	3	16	
	11	11	3,				15	1/8					H
	12-18	12-19					15-20						
	19	20		1			20		1			1	WPH
	20	21		4									
	21	22		2	3								
OS 1	0-S	3, 1,											
OS 2	2 ch.	2,	Off Strip Plot Runs N					4/9	Off Strip				
OS 3	East	1,											
OS 4													
1	22	23		3									
	23	24		5	2								
	24	25		3	1	2	25		17	6	2	25	
	25-39	26-40					30-40						WPH
	39	41		1	1								
	40	42		4		1							
	41	43		1									
	42	44		1	1								
	43	45		8			45		15	2	1	18	
	44	46		6	3	1	50		6	3	1	10	
	45-63	47-66					50-70						Fld.
	64	67		2	1								WPH
	65	68		4									
	66	69			1								
	67	70		3	1		70		9	3	0	12	
	68-72	71-76					75-80						H
	73	77		3		1							WPH
	74	78		7									
	75	79		9	1								
	76	80		2	1	2	80		21	2	3	26	
	End	Strip 2 Ch W of N.E. Cor											

RIBES ERADICATION

STRIP NO.	ORIGINAL TRANSECT NUMBER	ADJUSTED TRANSECT NUMBER	NUMBER RIBES BY F.L.S.	WHITE PINE COUNT			5-CHAIN TRANS. SUMM.						TIMBER TYPE
				CLASS "A" 0-4" DBH	CLASS "B" 5-12" DBH	CLASS "C" OVER 12" DBH	5-CH. TRANSECT	BU. / FLS	WHITE PINE				
									CL. A	CL. B	CL. C	TOT.	

C H E C K I N G

Although checking is often conducted in conjunction with white pine surveys, this phase of our control project will be briefly discussed separately because of the fact that much of our checking is done solely for the search of wild ribes. This is especially true in the case of regular checking. Also, when our white pine resurveys are completed we will be more concerned with ribes checking than with white pine mapping.

The details of the mechanics of checking will not be reported here since this is thoroughly taken up from pages 1 through 25.

DEFINITION AND PURPOSE OF CHECKING

Checking may be defined as a method whereby the ribes population of an area is sampled in order to determine the number of feet of live stem and the distribution.

The purpose of checking may be stated as follows: (1) To determine required standard of control following ribes eradication. (2) To examine an area for the occurrence of ribes prior to any ribes eradication and determine therefrom what control measures are needed. (3) To examine an area two or more years following ribes eradication in order to determine the status of control.

The above three items listed under purpose of checking can then be classified as three distinct types of checks, namely, (1) The Regular Check, (2) The Advance Check and (3) The Post Check.

The Regular Check: The regular check follows ribes eradication and should be conducted as soon as possible after the crews leave the area. The check may indicate the necessity of some rework. Hence on any one area there may be several regular checks. If an area is worked late in the fall or during the winter when most or all of the leaves have fallen off the bushes, the final regular check should be delayed until spring so the extent of "mop-up" work, if any, may be determined.

The Advance Check: The advance check is a check conducted on areas prior to any ribes eradication. So far most of our advance checks have been conducted in conjunction with preeradication surveys. The advance check is important in blocking out ribes-free areas.

The Post Check: Because most of our initial work has been completed, this type of check is now one of our most important checking activities, since through post checks we are able to determine the present status of control on work performed two or more years prior to such checks.

For more detailed description of Regular, Advance and Post Checks, see pages 36 and 38.

THE STANDARD OF CONTROL

In order to insure adequate protection to our white pine stands some kind of control standard had to be devised. The standard is based on the assumption that if the number of feet of live stem left per acre on an area is 25 feet or less, the area is relatively free from any serious blister rust damage. The number of feet of live stem left per acre should not be taken too literally, however. Based on an area as a whole the average feet of live stem per acre may show much less than 25 feet, although portions of the area may have a good deal more than 25 feet of live stem per acre, basing the per acre figure on the area involved. This situation is decidedly true in the Southern Appalachian Region where an area may contain a good deal of ribes-free country and many or few light or heavy ribes locations. Distribution of ribes, therefore, is an essential factor to consider before determining whether or not the area is safe to leave following or prior to any type of ribes eradication. The ribes distribution is directly concerned with checking since this is the only method we have in determining as accurately as possible an estimate, not only as to the feet of live stem left per acre on an area as a whole but also on integral parts of an area. This is why a checker's map (to be described later) is so essential.

CHECKING METHOD

Since all three types of strip checking follow essentially the same procedure in regard to method, an attempt will be made under this heading to explain certain facts common to all three classes of checking. Each type of check is more fully explained on pages 36, 37 and 38.

The Method of Sampling: Checking is based upon the method of sampling. If a sufficient number of sample plots systematically spaced are taken over a given area, the data thus collected can be considered as representative of the whole, and can be applied to the entire area.

The Standard System: Checking embodies the use of the strip, composed of consecutive transects (plots) one chain long by one-quarter chain wide; the direction of the strip is maintained by compass and the distance by pacing. The transect is the basic sample plot and the unit for recording ribes data. The checker will work alone, however, if the checking to be

done is in extremely rough and isolated country two men may be used. As in the case of the mapping crew, as previously described for the Grid System, if two men are checking one man will run compass and pace while the checker will busy himself recording ribes data and making the checking map. "Strip acres" is the term applied to the acreage actually examined on the check strip. It is computed by multiplying the number of chains of strip by the width of strip (1/4 chain) and dividing the product by 10. (10 square chains equal 1 acre). The acreage to which the sample applies is called Acres Covered, and is computed, if strips are paced 5 chains apart, by multiplying the strip acres by 20. If the coverage is based on a $2\frac{1}{2}$ percent check, pacing the strips 10 chains apart, the "Acres Covered" is determined by multiplying the "Strip Acres" by 40.

The Checking Unit: Since we have no United States rectangular public land survey system throughout the Southern Appalachian States our checking unit must either be an irregular white pine control area or a mile square grid or some other form of rectangular block. In the case of checking an irregular white pine control area, the check strips, if a good area map is available, are laid off prior to checking so as to insure an adequate representative coverage. In checking areas lying within a mile square grid or other type of surveyed block, the strips will be run so as to tie in to control points established by the survey. The method of running strips according to areas with irregular and regular control boundaries is illustrated graphically on page 38.

The Direction of Strips: Strips are run in cardinal directions, that is, either north and south or east and west, and the choice between these two should be that direction which will give the most representative sampling. For checks performed after crew work, the strips should cross the crew lanes at right angles unless this direction is impracticable. In other cases the strips should be run to cross the trend of the topography.

The Spacing of Strips: In order to be consistent in spacing our check strips all strips will be spaced not less than 10 chains apart and "then if the ribes pattern is inadequately revealed intermediate strips may be run over the whole or part of the area". All regular checks should be run on a five percent basis - spacing the strips five chains apart.

Recording Ribes and Feet of Live Stem: On page 10 it will be noted that ribes and feet of live stem are recorded to the west side of the 5-chain transect when strips run north and south and on the south side of the 5-chain transect when strips run east and west. This is done so that there will be no confusion with the white pine counts. However, when doing straight checking for ribes and ribes and feet of live stem should be

written as a fraction as has been done in the past. For strips running north and south record ribes data as follows:

= 7 ribes with 29 feet of live stem

For strips running east and west record this way:

= Ribes
= Feet of live stem

Ribes Eradication Types: Because of the limited number of ribes species in the Southern Appalachian States we have never considered any definite ribes eradication types. Instead of using such terms as "Rock drift" type, "Stream" type, "Cut over" type, etc., we have been using broad terms such as crew, and blockout types and I believe we are justified in doing so, since it would be practically impossible to devise definite eradication types to apply to Maryland as well as Georgia.

The Checking Field Map: No matter how detailed the checker's data sheets may be, nothing reveals the status of control like a good checking map. The checking map is to be made to a scale of 8 inches to the mile on Form EQ-435. The purpose of the checking map is to show graphically the amount and distribution of ribes on an area at the time the check was made. Other essential features such as roads, trails, streams, main ridges, etc., should be shown which will increase the usefulness of the map. Too many cultural or topographical features, however, should be avoided since it must be remembered that the ribes data is of primary importance and should not be obscured beyond recognition. The checking maps must be as accurate as possible and always neat. Note symbols to use in checking (page 24). Final checking maps are now incorporated with revised forms AP-1, for Advance and/or post checks and Form AP-2 for Regular checks. Special checking maps may be made however for areas with irregular control boundaries. Form EQ-435 is to be used for the checking map and later transfered to the 4 inch to the mile map on AP-1 if Advance or Post Check and to AP-2 if Regular Check.

Since we are not concerned with definite eradication types we need only show by outlining with a solid blue line, areas of crew work checked. As there is always the possibility of white pine being planted by various agencies we will consider all areas which appear to be favorable white pine planting sites on our checking maps. Possible white pine planting sites will be indicated on the checking or survey map by shading with yellow. (See legend on page 24.)

In the case of conducting post checks, where control area maps are available the map is to be transferred leaving off all details except the most essential. On the copied map the strips will be lined off in pencil and marked off with short dash lines every five chains. The strips should be so spaced as to give the best possible coverage. Strips are to be spaced five chains apart so if possible a maximum of five percent checks can be made. Strips will first be run in the field, however, at ten chain intervals. If the pattern does not then seem to be complete, all, or some, of the intermediate strips are run. Thus, if on a $2\frac{1}{2}$ percent check the area or portion of the area shows 25 feet of live stem or less per acre, the intermediate strips must be run so as to increase the percentage of sampling and thus eliminate any doubt concerning the ribes distribution. In the summary of checking plot studies conducted in the Northwestern Region in 1939, it was pointed out that although an 8 percent check detected more ribes than a 4 percent check, the distribution as shown on the checking map presented approximately the same pattern. Thus if an adequate distribution of ribes is presented on a $2\frac{1}{2}$ percent check it can be considered a waste of time and labor to conduct a 5 percent check, especially since our knowledge of ribes distribution is fairly well defined. Otherwise we should increase the percent of check only on those areas where the pattern is incomplete and on areas which we know from experience to be ribes-free. The practice is now to run a 5 percent Regular Check on all crew work performed.

The Running of Strips: As previously stated, the check strips are plotted on the checking map and marked off in 5-chain intervals. Since the actual strip as run will very seldom coincide with the plotted strip, adjustments must be made. If the check strips run too far to the right or left of the plotted strip the true course must be drawn in. An error in alignment of more than 1 chain must be adjusted whenever grid definite tie-in points are provided for, such as strip stakes used on grid control lines. On areas which were mapped from no base line it is necessary to establish one for the purpose of control, unless the old control line is considered accurate enough to use as a tie-in line. The plotting and running of check strips is illustrated on the sample map on page 22.

The width of Check Strip: The check strips are 1/4 chain ($16\frac{1}{2}$ feet) wide, the checker examining $8\frac{1}{4}$ feet on either side of him. Maintaining the proper width of strip is important since ribes found on the outer edge of the strips are just as important as those found on the center of the strip. The checker therefore must form the habit of periodically checking his strip width by pacing out $8\frac{1}{4}$ feet from the center line.

The Numbering of Check Strips: As previously mentioned, the northwest corner of the grid will be designated the reference corner as far as the numbering of strips are concerned. In conducting post checks the checker will use strip numbers 1, 3, 5, 7, 9, 11, 13 and 15. If intermediate strips are to be run he will use 2, 4, 6, 8, 10, 12, 14 and 16. For Regular checks the same strip numbering will be used for first Regular

checks the checking using 1, 2, 3, 4, 5, 6, etc. For rechecks the checker will use 37-52. The method of strip numbering is illustrated on page 32 For regular checks strip No. 1 does not have to refer to the northwest corner of the grid but to the first strip run in the crew block.

Recording of Data: Checking data is recorded on Form AP-4, revised (see pages 10 and 25) and summarized on AP-1 or AP-2 forms (see pages 47 and 48).

Checking Crowns and Seedlings: Crowns apply only to regular checks. Crowns are those portions of ribes which are often left by eradication crews because of improper pulling. If left in the ground these crowns will in due time sprout. Even a minute section of crown tissue left attached to a root will sprout under favorable conditions. The checker will not spend a great deal of time searching for crowns but make quick examinations of areas falling on his strips where the ground has been disturbed by the pulling of bushes. The examination should be a little more thorough however in rocky hollows and drifts where the chances of tearing off the live stem from the crown are increased. If many crowns are found on such rocky areas the use of chemicals may be recommended. The checker should indicate presence of crowns under "Checker's Notes" on Form AP-2 (see page 47).

Seedlings are recorded by using the letter "S" instead of showing F.L.S. Seedlings will be classed as bushes two years old or less. They may be recognized as having succulent stems, soft roots and no well defined crown. Do not record seedlings as live stem when such seedlings have 6" or less of live stem. If over 6" record to the nearest foot.

Recording Ribes Data on the Checking Map: (See page 12 for recording ribes and white pine and page 28 for recording ribes only).

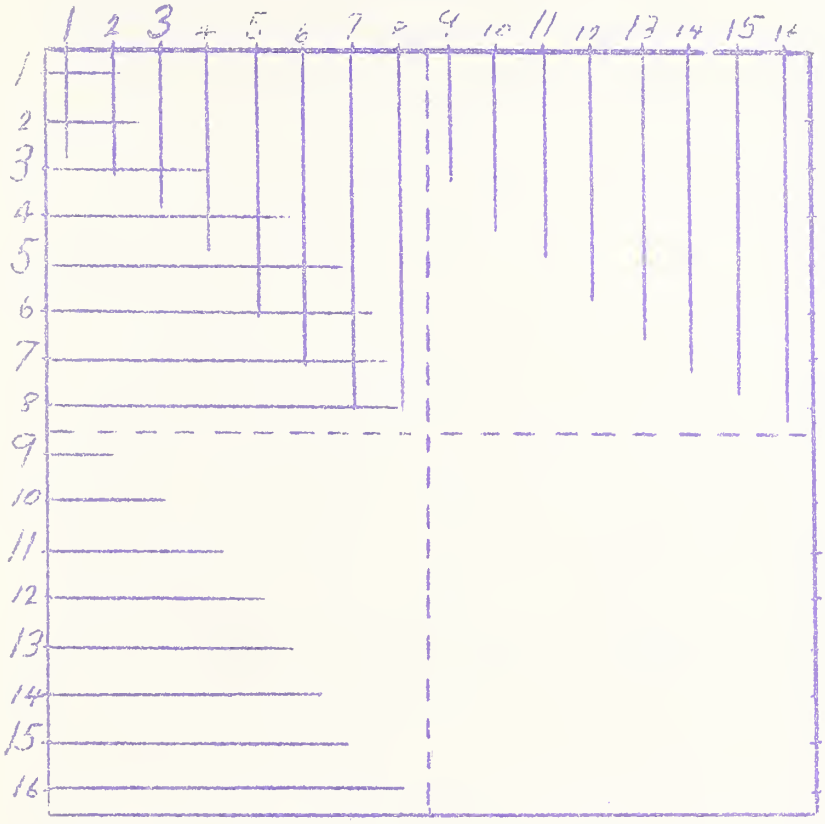
The Adjustment of Errors in Pacing: (See pages 15-17).

THE CHECKING ORGANIZATION

We must look upon checking as just as important an activity of blister rust control as we now consider ribes eradication, white pine surveys, and other special activities which occupy a great deal of our time. It is advised, therefore, that the Field Supervisors become thoroughly familiar with the checking methods as set forth in this manual so that competent men selected from the crews can be thoroughly instructed in the mechanics of checking.

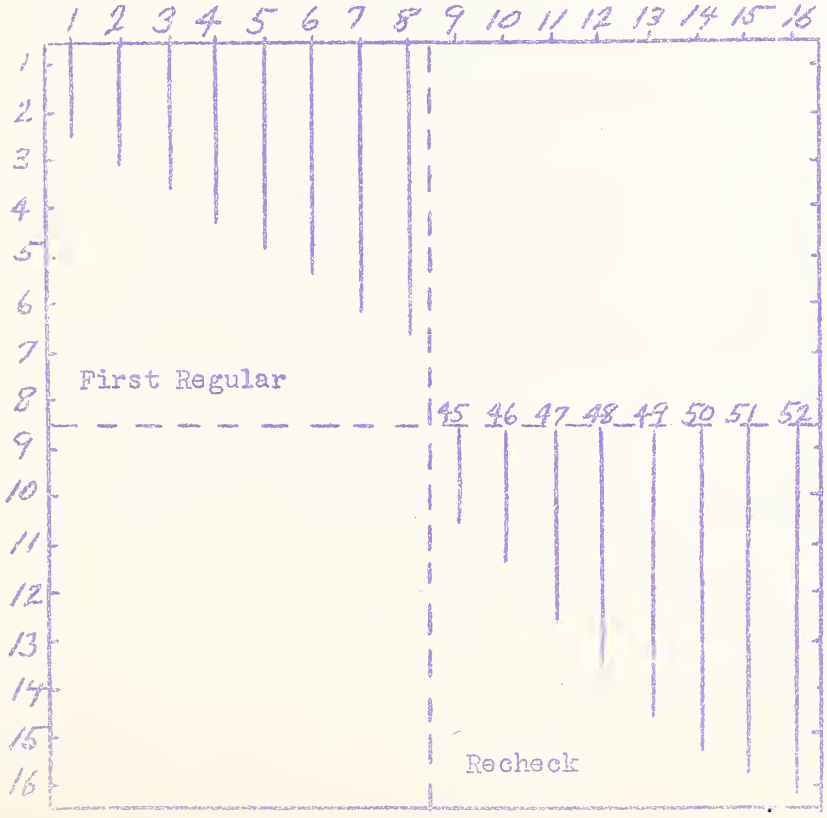
The Checking Crew: The checking crew will consist of one man who will run compass and pace, and look for and record all ribes found, make the checking map and see that strips are tied in properly. As soon as an area is completely checked the checker will turn in his data sheets and checking map to the Field Supervisor in charge. If the Field Supervisor feels that additional strips should be run in an area he will inform the checker to return to the area and run the intermediate strips as indicated on the map by the Field Supervisor.

METHOD OF NUMBERING STRIPS



Advance or Post

1 - 16



First Regular

1 - 16

Recheck

37-52

EXAMPLES OF CHECKING PROCEDURE

(1) Control Boundary Well Defined and Assumed Correct: An area is to be post checked for the first time. The area is quite irregular but the control boundary is well marked and assumed to be accurate. A checking map has been made from the old pine area map with strips spaced 5 chains apart indicated thereon with pencil. Definite tie-in points such as roads, trails, streams, traverse points, etc., are clearly shown. The strips are not numbered. This is left for the checker to do since it is not known just where he will wish to start his first strip until he gets to the area. The checker will normally, however, start his first strip on one extreme side of the area and work toward the other extreme until all of the strips are run. Since the map is assumed to be correct he will gauge his paced distance according to the map and make any adjustments in errors of pacing accordingly. After selecting his first starting point he will mark the location and direction which he is to run on the data sheet opposite the number of his strip. If running north he will proceed on a true north bearing and at the same time start pacing, using a tally register to indicate the number of paces. As the checking proceeds the checker will check various topographical and cultural features indicated on his map with actual ground conditions. If he is supposed to cross a stream at 18 chains but the pacing shows 21 chains he will lightly indicate the difference on the map with his pencil, redrawing in the stream where he crosses it. This is done throughout the strip until the control line is reached. Immediately he will record the chainage of the strip. If the paced distance is within one chain short or long of the distance indicated on the map no adjustments of errors in pacing are necessary and the checker can assume that all changes he has made on the map are correct and the original map in error. If, however, he fails two or more chains short or long of the assumed correct distance he must adjust for errors in pacing as explained on pages 15, 16 and 17. From the adjusted figures he will then check his map and correct any topographical or cultural features which are necessary. (See checking map legend on page 24). The checker's next step will be to check on his alignment. This may be rather difficult to do where there are no strip stakes to tie-in with. However, if the original map is fairly accurate he will in many cases have certain ground features such as streams, roads, trails, railroad grades, etc., to roughly locate his position. If from the map he is supposed to "hit" within 1-chain west of the intersection of a small stream and the control zone boundary and he finds himself three chains west he can assume then that he has veered two chains to the left and can realign his strip on the map accordingly. After establishing the correct tie-in point he then off-sets 10 chains, east or west as the case may be, and if the location seems to agree with that indicated on the map he starts his second strip running due south, recording data as before. If the checker discovers after running one or two strips that he cannot tie-in any points indicated on the map within a reasonable degree of accuracy he must resort to the method described under (2) in the following paragraphs.

(2) Control Boundary Not Well Defined and not Assumed to be Correct. On white pine areas to be checked which have no well defined control zone and where the original map is inadequate it will be necessary to establish one or more base lines before starting to do any checking. On small areas where the check strips will not exceed 40 or 60 chains in length one base line run approximately through the center of the area at right angles to the direction of the check strips will suffice. If the area is large two base lines will be necessary, established far enough apart so as to incorporate all of the pine area and as much of the protective zone as can be determined. The base lines will be established with compass and chain, setting stations every five chains. If two base lines are run the numbered stations must agree with one another. When one base line is established the checker locates the first station and runs his course until he assumes that he has gone out far enough. He then off-sets his ten chains and ties into the proper station on the base line. Since it is impossible to correct for alignment on the distance paced from one base line the checker can determine any marked degree of error when he returns and ties into the base line. Since the accumulated errors in pacing and alignment are in proportion to the length of the strip run, it is best that the checker complete all checking on one side of the base line before checking on the other side. Thus, if the base line runs east and west all checking will be done on the north side of the base line first and then on the south side. If two checking crews are used both sides can be run simultaneously. The checking map in this case will be the basis for a new pine area map if pine counts are made follow the procedure as outlined on page 10. When pine counts are made the work would be classed as resurvey and all man hours and costs charged to same. Two men should be used on resurveys.

In using two base lines the check strips are run the full length through the area, adjustments being made in alignment and distance by checking into base line stations. If the checker feels that the base lines are not far enough apart to cover the control zone he may extend the necessary strips out beyond the base line in question.

(3) Checking Areas Which are Confined Within a Previously Established Rectangular Control Survey System. Where the grid survey system is employed checking becomes a relatively simple procedure. If an area is worked by grids or blocks the check strips can be so located as to tie-in with control stations originally established by the control survey crews. A checking map is of course made but only to cover that portion of the grid or block to be checked. This map is made on the 8" to the mile map FQ-435 The final map being transferred to forms AP-1 or AP-2 whichever the case may be.

All checking procedures as explained under items (1), (2) and (3) are graphically illustrated on page 38.

ESTABLISHING BASE LINES AS A CONTROL FOR CHECKERS

1 Base Lines Established by Survey: When checking is done by mile square grids where survey control lines are established, the checker should have little difficulty in laying out his strips so as to tie-in with these previously established control points.

In order to locate the proper control survey lines, corners, location tags or strip stakes, the checker should always use the survey maps as a guide. If however, corners, location tags, strip stakes and survey lines are obliterated, one or more of the old survey lines should be reestablished before any checking is done. When a lost corner or other form of location marker has been reestablished the line should be run as near as possible to coincide with the original survey. Here again the old survey maps will be a helpful guide. Strip stakes or checking tags should then be set every five chains along the reestablished line, extending the line or lines far enough to cover the ribes-bearing area or areas to be checked. Strip stakes or checking tags thus adequately set and numbered will then be used as checking control points. If the original strip stakes were set and it is decided that the check strips should be run at right angles to the original survey strips, it will be necessary to establish a checking control line setting the tie-in steaks or tags in a line which is at right angles to the old survey control lines. When a checker spends time reestablishing old survey lines and corners, his hours thus spent should be charged to other activities. See Form AP-3, revised, pages 50 and 51.

2. Base Lines Established by Checker: When checking areas which were surveyed by the traverse system where original map is inadequate and not assumed to be correct, and with no established base line, it will be necessary to establish one or more base lines for the purpose of check strip tie-ins and to build up an accurate checking map. On small areas where the control zone boundaries are no more than 60 chains apart at the widest point, one base line run through the area as near to the center as possible will suffice. The base line should always be run in cardinal directions (north and south or east and west) so the error of reading compass angles in reverse order will be lessened. The base line should be well marked by cutting out brush and setting strip stakes or tags every 5 chains. A string line stretched along the base line is advised so no time will be lost by the checker looking for the base line. Checking control strip stakes or tags should be marked as indicated on the data sheets and checking map. Thus, if the check strips are run north and south with strip "1 starting on the west end of the base line, the strip stakes or tags would be numbered consecutively from west to east. To eliminate any large errors in pacing when only one base line is used, it is advisable to check from one side of the base line first and then the other. See page 38. In large areas to be checked where the paced distance is greater than 60 chains it is advisable to establish two base lines, running the strips between two control base line stakes which are set directly in line with each other.

3. Road Traverse Control Stations: Where grid control is established from protracted points along a road, stream or ridge base line the checker will use these points for starting and tie-in stations. Review section on "Establishing Base Line By Road Traverse", Part II, pages 45-50, inclusive.

4. No Base Line Used: When a small area has been accurately mapped by the survey crew the check strips may be plotted on a copy of the survey map prior to checking and run in the field according to certain established tie-in points indicated on the map. Such points may be painted trees, control line stakes, road or stream intersections, buildings, etc. In running check strips on this type of area it will probably be difficult to adjust for any errors in pacing unless the control points indicated on the map are actually tied in on the ground and the distances indicated on the plotted strips are assumed correct. See diagram, page 38.

TYPE OF CHECKS

1. Regular Checks: Revised Form AP-2 is to be used when regular checks are run. Regular checks are to be conducted following all crew work allowing enough time for the pulled bushes to wilt so green sprouts, sprouts or missed bushes can more readily be detected. On the first regular check all data from the checker's AP-4 data sheets will be summarized and entered in the column headed "1" on Form AP-2. Prior to running the first regular check the crew block to be examined is marked off on the 8" to the mile checking map (Form EQ-435) and the checking strips laid off accordingly. Although this map is chiefly to be used as a guide for the checker it will also serve as a basis for outlining rework areas by the Field Supervisor. When rework is completed the checker makes a second regular check and his data is recorded in the column headed "2". This procedure is followed until the area is considered safe to leave. If an area is worked during the dormant season or very late in the fall, the first regular check should be made the following spring with a second regular check following "mop-up" work if such work is necessary. Procedure to follow in summarizing regular checks is illustrated on pages 43, 45 and 47.

2. Advance Checks: Advance checks are to be considered only on areas which have had no ribes eradication work performed. The advance check is to determine the status of control work to be performed in respect to crew work. It is a method of sampling so as to eliminate the expense and time of running a full ribes eradication crew over the area to hunt out ribes-bearing areas. It is our best method therefore in delimiting ribes-free areas from ribes-bearing areas, thus enabling us to concentrate all crew work on areas where the crews can expend their time profitably. Where the survey map does not show an adequate sampling of ribes-bearing areas the checker will run intermediate strips to complete the pattern and tie-in that portion of the area which he maps with the survey map in building up the completed advance checking map. All advance checking data is recorded on revised Form AP-1.

3. Post Checks: Post checking is one of our most important checking activities. Any checks conducted two or more years following ribes eradication are to be classed as post checks. Before starting the post checking work in any State all pine area records should be analyzed and a checker's work plan compiled. Many factors such as white pine priority, ownership, accessibility, number of ribes originally eradicated, etc., will have bearing on selecting areas to be post checked during the current season. All areas in need of being post checked however should be listed in the permanent control records so that an orderly procedure may be followed. Each area to be post checked should have a map showing the strips plotted thereon. If no map is available the checker is to make one according to methods already described. See pages 33, 34 and 35. Revised Form AP-1 is to be used for Post Checking. (See page 47.)

4. The "Checker-Flanker" Method in Conducting Post Checks: The "Checker-Flanker" method of running checks has been used to some extent in the Northwest. The method was devised to conduct checking and ribes eradication in one operation. It should be used, however, in our region only in conjunction with post checking.

The "Checker-Flanker" crew consists of three men, one checker and two flank men. The checker runs the compass, paces and records ribes data on his strip as well as pulls all bushes found. The flank men work on both sides of the checker, zigzagging back and forth, covering as much territory as visibility allows. Rarely should the flank men exceed a distance of 2½ chains from the center line followed by the checker. This would give a maximum coverage of 5 chains on each strip.

No string lines are used since offsets and strip lines are run with compass.

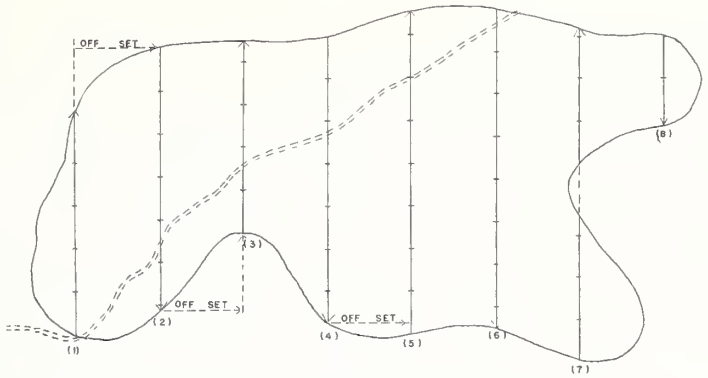
When large concentrations of ribes are located this type of checking organization should be abandoned and the regulation post check run, delimiting the ribes-bearing areas for regular crew work.

Charge all time to ribes eradication when a Checker-Flanker crew is used.

MAN HOURS CHECKING

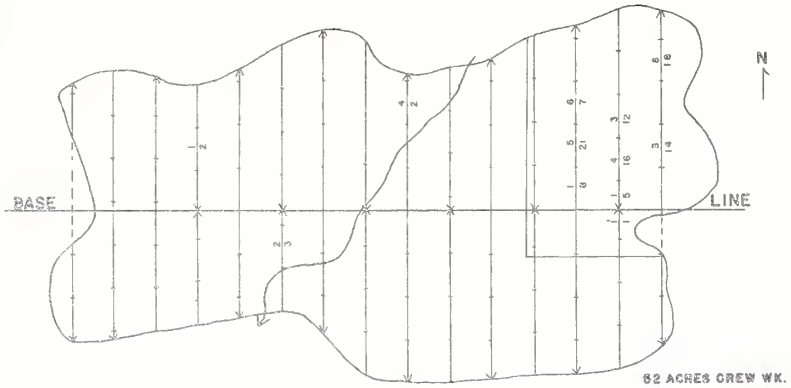
Confusion has resulted in the past by trying to prorate checking man hours between checking, ribes eradication and survey. From now on all checker's time will be charged against checking and by the type of check run, and we will consider checking only inthe light of searching for ribes and recording the number of feet of live stem found. If a checker is sent out to make a white pine map he is not checking in the true sense of the word, but is doing survey work and his time should therefore be charged to survey. Time spent by the checker to relocate old grid corners, base lines and other types of control points should be charged to other activities, especially if it takes him more than one hour in the field to locate himself. See Daily Analysis Sheet for Mappers and Checkers, (Form AP-3, revised), page 50.

STRIP CHECKING AS APPLIED TO VARYING FIELD CONDITIONS



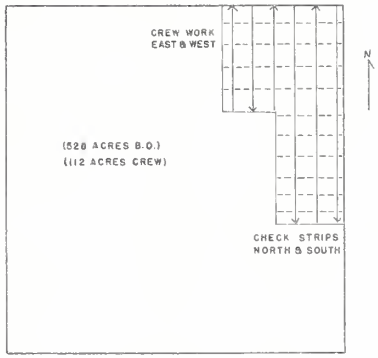
CHECKING A WHITE PINE AREA OF IRREGULAR SHAPE. STRIPS PLOTTED ON MAP PRIOR TO CHECKING SO AS TO ASSURE PROPER COVERAGE AND PERCENT OF CHECK. (CONTROL BOUNDARY WELL DEFINED AND ASSUMED CORRECT.)

SCALE-8"=1 MILE
230 ACRES IN AREA
5.8 STRIP ACRES CHECKED
2.5% CHECK

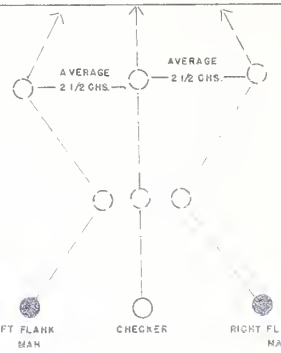


CHECKING A WHITE PINE AREA OF IRREGULAR SHAPE WHERE CONTROL BOUNDARY IS NOT WELL DEFINED AND NOT ASSUMED TO BE CORRECT. (ONE BASE LINE USED FOR CONTROL. LENGTH OF CHECK STRIPS DETERMINED BY CHECKER TO ASSURE PROPER COVERAGE OF CONTROL ZONE. NEW PINE AREA MAP MADE BY CHECKER.)

SCALE-8"=1 MILE
256 ACRES IN AREA
12.4 STRIP ACRES CHECKED
5% CHECK



CHECKING RIBES AREAS IN GRIDS OR BLOCKS (FOLLOWING ERADICATION) WHICH HAVE BEEN LOCATED AND DEFINED ON PREERADICATION SURVEY MAPS



POSSIBLE USE OF THE "CHECKER-FLANKER" METHOD IN CONDUCTING POST CHECKS. CHECKER AND FLANK MEN PULL ALL RIBES FOUND, UNLESS BUSHES ARE TOO NUMEROUS WHICH WOULD CALL FOR REGULAR CREW WORK.

THE RECORDING OF BLOCKOUT ACREAGE

Ever since we have been using the term "blockout" in our reports there has been considerable misunderstanding as to its proper classification. Blockout acreage is any acreage covered by advance checks or on surveys on which no ribes are found and is therefore ribes-free. On old areas which were originally worked by scout crews and the ribes-bearing areas are not defined, such as areas or portions of areas may be reclassified as blockout acreage when post checks are conducted. No ribes-bearing areas will be classed as blockout unless definitely reduced to a permanent maintenance status. If not on permanent maintenance such areas are recorded as either being retained as crew work areas for future checking or working or as being on maintenance - "Other".

It must be remembered that blockout acreage is a definite part of our ribes eradication program just the same as crew work.

Under certain conditions areas blocked out (as ribes-free) may some day contain ribes. Such situations may arise from fires, logging and other factors causing the stand to open up and offering favorable germination for ribes seeds. This, of course, is a condition we cannot always foresee. To play safe, areas within five to ten chains of a ribes-bearing area should never be claimed as blockout. Always extend the crew blocks at least five chains beyond the extreme limits where ribes are found.

If post checks are used to determine blockout acreage on old scout work because of indecision regarding ribes distribution, the man hours spent on post checking will be charged directly to checking as usual for this type of check. The only change will be a shift in classification for so many acres scout to blockout on the permanent control record.

FIELD AND OFFICE FORMS

Since the first revised checking manual was issued in 1943 a number of revisions have been made in the matter of checking forms. The checking forms now used are; the data sheet, Form AP-4, revised; the Survey and Checking Summary Sheet (for advance and post checks only), Form AP-1, revised; the Ribes Eradication and Regular Checking Report now included on Form AP-2, revised; and the Daily Analysis Sheet for Mappers and Checkers, Form AP-3, revised.

The Survey and Checking Data Sheet, Form AP-4, revised: This form is the checker's field data sheet. This same form is also used for survey crews to record white pine and ribes data. It is not necessary to make copies of the data sheets but the original should be filed after the data has

been summarized. The Field Supervisor should carefully check the data sheets turned in by the checker to see if they are properly executed. He should especially see that care was taken in adjusting the errors in pacing. The checker is to make his own adjustments. Effort should be made to train the men in the field to carry out this simple procedure of adjusting the errors in pacing. See sample AP-4 on page 25.

The Survey and Checking Summary Sheet, Form AP-1, revised: This report form is to be used for the final checking survey on a grid or area for advance or post checks only. In general, the form is divided into 8 parts; (1) Heading, (2) Survey Data, (3) Stand Data, (4) Checking Data (data taken from completed AP-4), (5) Control Data (data supplied from Survey and Checking Data) (6) Disease Survey, (7) Checking Map and (8) Case History.

The properly completed AP-1 form when attached to the original survey map will be of great aid in conducting ribes eradication. The map is of special importance since it will show at a glance what portions of the grids are in need of crew work and what portions are ribes-free. All crew block boundaries should be marked off in rectangular blocks so they will be easier to locate and found in the field. Avoid too much detail on the maps. Besides the ribes data show only main roads, ridges and streams. Remember the main purpose of this map is to show ribes and their distribution. See sample AP-1 Form on pages 48 and 49.

Ribes Eradication and Regular Checking Report, Form AP-2, revised: Because regular checking is so closely tied up with ribes eradication it was decided to combine the regular checking report and ribes eradication report on one form.

The revised AP-2 form is divided into six parts; (1) Heading, (2) Control Record, (3) Status of Control, (4) Checking Data, (5) Checking Notes and (6) Regular Checking Map.

The control record section is a record for ribes eradication performed on any one grid during the current season. Acres worked are kept by ownership but man-days and ribes pulled are not. The three "rework" lines are to be used only if the first regular, second regular, etc., checks indicate a need of reworking on all or part of the grid because of the standard of control was not attained on previous workings. Rework is often performed on the decision of the crew leader or foreman in charge over several strips which he is certain will not check out. Such rework as this does not need to be listed as rework on the form but included with the regular working. Rework, therefore, means any working necessary after a regular check is made. Under "per acre" the cost per acre can be determined by using the average current man-day labor cost times the man-days expended, divided by the total acres worked and reworked.

The "Status of Control" is for the purpose of showing the status of ribes eradication on the grid to date. Acreage shown in this section will be "net" acres which will be the actual acres retained under control at the time of the latest survey and working.

The checking data will, of course, be taken from the checker's AP-4 form. After ribes eradication the first regular check will be entered in column "2", etc.

Under checking notes, the checker for each regular check made will indicate in the proper block the presence of seedlings, missed bushes, sprouts, etc., by using a (✓) mark.

The regular checking map is important and should show the final status of the checking work performed on the grid or portion thereof. See sample data sheets for first regular and second regular checks and completed sample AP-2 (pages 43, 45 and 47.

Daily Analysis Sheet for Mappers and Checkers, Form AP-3, revised: On page 50 is a sample AP-3, revised, showing the proper way to fill in the columns for survey crews, checks, other activities and a page for ribes eradication.

Checker's Tags: For some time now we have been using checker's tags which are hung up at the beginning and ending of the strips as well as along trails, roads and stream crossings. In marking up these tags there has been quite a bit of variance throughout the region.

If a grid is checked shortly after the survey is completed, the checker will tie in his strip to tags already hung by the control survey crew (see page 7 and page 47 of Part II of this manual).

So that some uniformity can be maintained it is suggested that tags be marked as follows:

A grid is to be post checked following survey and mapping. The survey crew set tags every 2½ chains along the north line and the south line. The tag 2½chains east of the northwest corner is marked Strip #1, 7½ chains from the corner, Strip #2, etc. Being a post check the checker locates the tag marked Strip #1 and puts up his own tag marked as follows:

START STRIP #1 South

Grid B-10 Block 10

○ 2½ E of N.W. Corner

First Post Check

Date _____ Name _____

The system of marking tags will follow the same procedure as for mappers described on page 19. When the checker crosses a road or trail he will indicate on the tag the location as follows if he is 10 chains south of his starting point.

STRIP #1 South

Grid B-10 Block 10

○ 2½ E 10 S. of N.W. Corner

1st Post Check

Date _____ Name _____

It will be noted that the tag will bear the location with respect to the nearest corner and not to the point of origin as in the case of the strip number. Thus, when the checker ends his strip on the south line of the grid he will mark his tag as follows:

END STRIP #1 South

Grid B-10 Block 10

○ 2½ E of S.W. Corner

1st Post Check

Date _____ Name _____

Pacing Tables:

Since the length of pace varies with different individuals it is often necessary to have a supply of pacing tables on hand which the pacer can paste in his tatem holder. The tables on page 52, 53, 54 and 55 are made up for pacers taking 11 paces per chain, 11½ paces per chain, 12 paces per chain and 12½ paces per chain.

After a checker has had considerable experience in pacing he will seldom need to refer to his table.

AP-4
(REV. 12-17-48)

SURVEY AND CHECKING DATA SHEET

BLOCK NO. 4

STATE: Virginia OWNERSHIP: Fed. & Priv. GRID NO. H-10

COUNTY: Augusta FOR. OR PARK: Forest AREA NO.

QUADRANGLE: NAME OF AREA:

TYPE OF CHECK: 1st Regular (ADV. — POST- REGULAR) TYPE OF SURVEY: (PRE-ERAD. — RESURVEY)

CHECKER: John Doe DATE: 7/15/50 MAPPER: DATE:

STRIP NO.	ORIGINAL TRANSECT NUMBER	ADJUSTED TRANSECT NUMBER	NUMBER RIBES BY F.L.S.	WHITE PINE COUNT CLASS "A" 0-4" DBH	CLASS "B" 5-12" DBH	CLASS "C" OVER 12" DBH	5-CHAIN TRANS. SUMM. 5-CH. TRANSECT	BU. / FLS	WHITE PINE CL. A	CL. B	CL. C	TOT.	TIMBER TYPE
1E	Start Strip 1E Chs 5 - All W on Rge E												
	0-40						5-40						
	0		4				40	5-T					
	0-40						40-40						
2W	Off set 5 Chs S on Strip 1 Rge W												
	0-21						5-25						
	22		4										
	23		4				25	2-T					
	24-40						25-40						
3E	Off set 5 Chs S on Strip 2 Rge E												
	0-29						5-30						
	28		2				30	1-T					
	29-40						30-40						
4W	Off set 5 Chs S on Strip 3 Rge W								W				
	0-24						5-25		A				Found
	21		4	2			25	2-T					
	22-40						25-40						
5E	Off set 5 Chs S on Strip 4 Rge E												
	0-18												
	19		4	1									
	20		2	2			20	5-T					
	21-40						20-40						
6W	Off set 5 Chs S on Strip 5 - Rge W												
	0-19						5-20						
	18		2				20	1-T					
	19-40						20-40						
7E	Off set 5 Chs S on Strip 6 - Rge E												
	0-40						5-40						
8W	Off set 5 Chs S on Strip 7 - Rge W												
	0-40						5-40						
	End Strip on W grid line - 2 Chs N of 24 6" yellow pine						0-40	Cor. Line					W

STRIP NO.	ORIGINAL TRANSECT NUMBER	ADJUSTED TRANSECT NUMBER	NUMBER RIBES BY F.L.S.	WHITE PINE COUNT			5-CHAIN TRANS. SUMM.						TIMBER TYPE
				CLASS "A" 0-4" DBH	CLASS "B" 5-12" DBH	CLASS "C" OVER 12" DBH	5-CH. TRAN-SECT.	BU./FLS	WHITE PINE				
									CL. A	CL. B	CL. C	TOT.	

PART III

AP-4
(REV. 12-17-45)

SURVEY AND CHECKING DATA SHEET

BLOCK NO. 4

STATE: Virginia OWNERSHIP: Fed. & Priv. GRID NO. H-10

COUNTY: Augusta FOR. OR PARK: Forest AREA NO.

QUADRANGLE: NAME OF AREA:

TYPE OF CHECK: 2nd Regular (ADV. — POST- REGULAR) TYPE OF SURVEY: (PRE-ERAD. - RESURVEY)

CHECKER: John Dale DATE: 7/16/45 MAPPER: DATE:

STRIP NO.	ORIGINAL TRANSECT NUMBER	ADJUSTED TRANSECT NUMBER	NUMBER RIBES BY F.L.S.	WHITE PINE COUNT CLASS "A" 0-4" DBH	CLASS "B" 5-12" DBH	CLASS "C" OVER 12" DBH	5-CHAIN TRANS. SUMM. 5-CH. TRANSECT	BU. / FLS	WHITE PINE CL. A	CL. B	CL. C	TOT.	TIMBER TYPE
37	Obs set		2½ chs E	of SW Vermont block cor			Ran N						
	0-3												
	3		3,				5	1/3					
	4-10						5-10						
38	Obs set		5 chs E	Ran 10 chs. S to block line									
	0-10						5-10						
	Note:		4 lines complete Final check on grid H-10										

STRIP NO.	ORIGINAL TRANSECT NUMBER	ADJUSTED TRANSECT NUMBER	NUMBER RIBES BY F.L.S.	WHITE PINE COUNT			5-CHAIN TRANS. SUMM.						TIMBER TYPE
				CLASS "A" 0-4" DBH	CLASS "B" 5-12" DBH	CLASS "C" OVER 12" DBH	5-CH. TRANSECT.	BU. / FLS	WHITE PINE				
									CL. A	CL. B	CL. C	TOT.	

AP-2
(REV.12-17-45)

RIBES ERADICATION AND REGULAR CHECKING REPORT

STATE: Virginia OWNERSHIP: Fed. & Priv BLOCK NO.: 4
COUNTY: Augusta FOR. OR PARK: GRID NO.: H-10
QUADRANGLE: NAME OF AREA: AREA NO.:
OPERATING AGENCY: Bureau DATE ERADICATED: July (MONTH) 1945 (YEAR)

CONTROL RECORD

OWNERSHIP	WORKING (1ST. 2ND. 3RD., ETC.)	ACRES WORKED			MAN-DAYS		RIBES PULLED			PER ACRE		
		CREW	B.O.	TOTAL			WILD	CULT.	TOTAL	MAN-DAYS	RIBES	COST
Federal	2nd	-	80	80		50	1,825		1825	.52	12.7	*1-70
Private	2nd	160	400	560	RE WORK 1	8	210	20	230			
					2							
TOTAL		160	480	640	3							
			TOTAL→			58	2035	20	2055			

STATUS OF CONTROL

OWNERSHIP	CONTROL ACRES	ACRES WHITE PINE			ACRES ON MAINTENANCE			YEAR PREV. WORK
		NATIVE	PLANTED	TOTAL	RIBES-FREE	OTHER	TOTAL	
Federal	80	40	-	40	80		80	1937
Private	560	400	40	440	400		400	1939
TOTAL	640	440	40	480	480		480	

CHECKING DATA

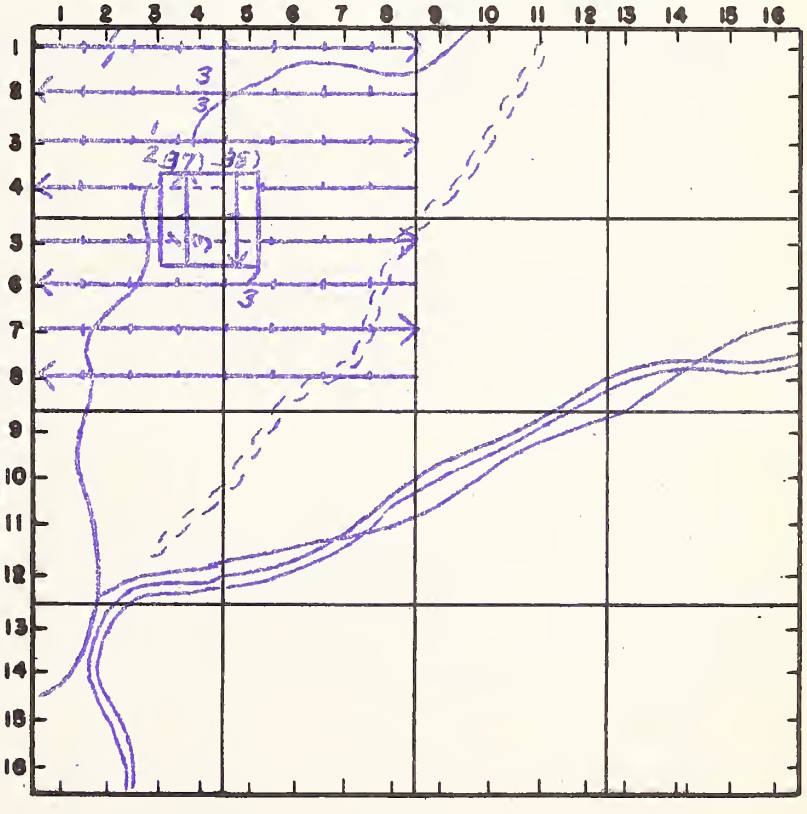
STRIP DATA	1	2	3	
STRIP ACRES	8.0	0.5		
ACRES COVERED	160	10		
TOTAL RIBES	14	1		
TOTAL F.L.S.	28	3		
RIBES PER ACRE	1.8	2.0		
F.L.S. PER ACRE	3.5	6.0		

CHECKING NOTES

SEEDLINGS				
MISSED BUSHES	✓	✓		
SPROUTS	✓			
CROWNS LEFT				
BUSHES HUNG PROPERLY	✓	✓		
DATES CHECKED	7/10	7/15		

John Dale-Checker

REGULAR CHECKING MAP



RIBES ERADICATION

AP-1
(REV. 12-17-45)

SURVEY AND CHECKING SUMMARY SHEET
(USE FOR ADVANCE AND/OR POST CHECKS ONLY)

STATE: Virginia OWNERSHIP: Fed. & Priv. BLOCK NO: 4

COUNTY: Augusta FOR. OR PARK: GRID NO.: 4-10

QUADRANGLE: NAME OF AREA: AREA NO.:

TYPE OF SURVEY: Resurvey (PREERADICATION — RESURVEY) TYPE OF CHECK: 1 yr Post* (ADVANCE — POST*)

SURVEY MADE: June 1945 (MONTH) (YEAR) CHECK MADE: June 1945 (MONTH) (YEAR)

SURVEY DATA

OWNERSHIP	TOTAL ACR'S WHITE PINE MAPPED	ACRES WHITE PINE WORTH PROTECTING				ACRES MAPPED	PERCENT SURVEY
		NATIVE		PLANTED	TOTAL		
		OVER 50	UNDER 50				
Fed.	40	40	—	—	40	80	2.5
Priv.	440	380	20	40	440	560	2.5
TOTAL	480	420	20	40	480	640	2.5

STAND DATA

PERCENT W.P. BY DIAMETER CLASS			AVERAGE NUMBER W.P. PER ACRE				PRIORITY CLASS
CLASS "A" 0-4" DBH	CLASS "B" 5-12" DBH	CLASS "C" OVER 12" DBH	NATIVE			PLANTED	
			OVER 50	UNDER 50	TOTAL		
65	25	10	314	46	310	860	☐ 1 2 3 4

CHECKING DATA

STRIP ACRES		% CHECK		ACRES COVERED		RIBES SPECIES	TOT. NO. BUSHES	TOT. NO. F.L.S.	PER ACRE	
CREW	B.O.	CREW	B.O.	CREW	B.O.				BU.	F.L.S.
8.0	—	5	—	160	—	Cynosbati	85	224	10.6	28.0
						TOTAL	85	224	10.6	28.0

CONTROL DATA

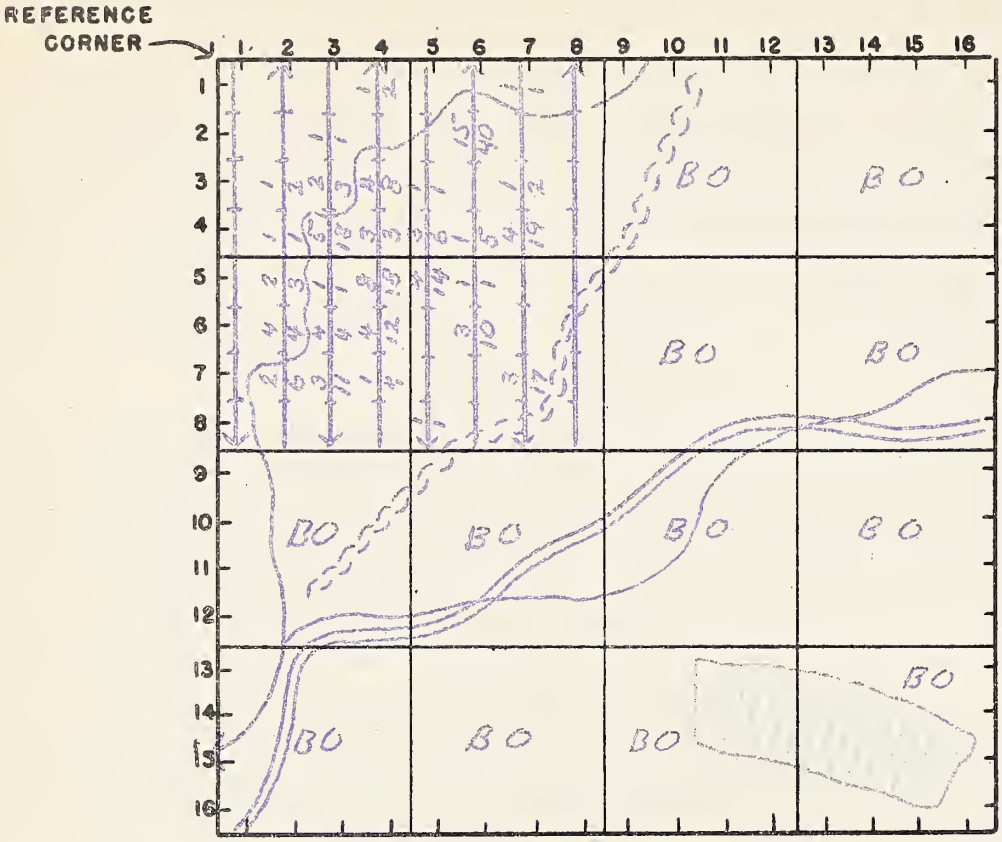
ESTIMATE FOR RIBES ERADICATION					PER ACRE		CULTIVATED BUSHES	
OWNERSHIP	ACRES TO WORK			MAN-DAYS	RIBES	F.L.S.	NO. PROPERTIES INSPECTED	NO. BU. LOCATED
	CREW	B.O.	TOTAL		CREW	CREW		
Fed.	—	80	80	200	10	28	3	16
Priv.	160	400	560					
TOTAL	160	480	640					

DISEASE SURVEY

STRIP NO.	INFECTION ON RIBES		NEAREST WHITE PINE	INFECTION ON WHITE PINE							
				APPROX. ACREAGE	STG. OF INFECTION			STEM CANKERS	BRANCH CANKERS	% INFECTION	FIRST YEAR INF
	HEAVY	LIGHT			INCIP.	PYC.	FRUITING				
3-80		✓	15'								

* IF POST CHECK - INDICATE IF IT IS IST., 2ND, 3RD, ETC.

(CHECKING MAP ON BACK)



SHOW NUMBER OF STRIPS RUN; DIRECTION AND RIBES DATA

CASE HISTORY DATA

(Write a short history of area; status of ownership, logged, burned, white pine conditions, ribes condition, recommendations, etc.)

This grid has a fine stand of young white pine. There is a good scattering of seed trees. Area for the most part logged off about 15 years ago. Entire grid falls in Forest Service purchase area. Hardwoods of poor quality. Much dead chestnut in southeast section of grid. Ribes found only in N.W. quarter of grid. Most bushes found on steep, rocky northwest slope. Large percentage of bushes found on check were sprouts.

AP-3
(REV. 12-17-45)

PART I

DAILY ANALYSIS SHEET FOR MAPPERS AND CHECKERS
(RIBES ERADICATION ON REVERSE SIDE)

STATE: Virginia COUNTY: Augusta OPERATING AGENCY: Bureau

TIME KEEPER: John Doe REPORTING PERIOD: July 1-14 YEAR: 1945

DATE	NO. OF MEN IN PARTY	SURVEY				CHECKING						OTHER ACTIVITIES		TOTAL HOURS WORKED
		CONTROL		MAPPING		ADVANCE		POST		REGULAR				
		HOURS WORKED	CHAINS RUN	HOURS WORKED	STRIP ACRES	HOURS WORKED	STRIP ACRES	HOURS WORKED	STRIP ACRES	HOURS WORKED	STRIP ACRES	HOURS WORKED	DETAIL	
2	2			16	5									16
3	3			8	3							8	½ day re-locating and establishing grid ~~est. [illegible]~~	16
4	1							8	4					8
5	1							8	4					8
6	1											8	Rain; worked in off. assist. Fld. Super.	8
9	2							8	3	8	2			16
10	1									8	2			8
11	1									4	1	4	Asst. Foreman running in New crew block time	8
12	2							16	6					16
13	1							4	2			4	4 hrs. Annual leave	8
TOTAL	—	—	24	9	—	—	44	19	20	5	24			112

AP-3
(REV. 12-17-45)

DAILY ERADICATION REPORT

STATE:_____ COUNTY:_____ FOREST:_____ YEAR:_____

BLOCK NO._____ GRID NO._____ LOCATION_____

OPERATING AGENCY:_____ REPORTING PERIOD:_____

DATE	RIBES ERADICATION						OTHER ACTIVITIES		TOTA HOURS WORKED
	NO. MEN IN PARTY	ACRES WORKED	RIBE PULLED			HOURS WORKED	HOURS WORKED	DETAIL	
			WILD	CULT.	TOTAL				
TOTAL									

RIBES ERADICATION

PART IV

RIBES ERADICATION

I N D E X

RIBES ERADICATION

INTRODUCTION

This is the first manual prepared for use in the Southern Appalachian Region which has a section on Ribes Eradication. So far all instructions on methods of pulling ribes have been given directly in the field by the Field Supervisors. For the most part such instructions have been effective but as in the case of checking, white pine mapping and other blister rust activities, there has been a great deal of variation as to methods used and only too often a new supervisor or foreman is more or less left to his own devices to work out methods of his own which may or may not be logically sound.

In this section of the manual, therefore, we will discuss the various phases of the field work as it applies to the pulling of individual ribes bushes, crew formation, crew work and where ribes grow.

Since it is impossible to cover all situations which may arise in the field it will, of course, be necessary for the Field Supervisors to make their own decisions when special problems arise or consult with their Area Leaders.

ORGANIZATION OF RIBES ERADICATION UNITS

Very seldom have we resorted to the use of camps in the Southern Appalachian Region. Our men are usually hired from local communities in the mountainous sections of the region who are picked up by truck at designated locations in the morning and returned by truck after the day's work is completed.

Each Field Supervisor has a certain area assigned to him from which crews are to eradicate ribes and it is the responsibility of the Field Supervisor to see that the men under him are properly trained.

Each Field Supervisor should have a well organized work plan and his men well organized with respect to their abilities. He should be able to determine which men are to be crewmen, crew leaders, sub-foremen and foremen. He should always keep a good balance between these various classes of positions as he does with his mapping and checking organization.

Foreman:

The Foreman assists the Field Supervisor whenever he is needed and should be capable of taking over in the case of the Field Supervisor's absence. If the operation is large the Supervisor should employ enough Foremen to handle the job effectively and efficiently.

Sub-Foreman:

The Sub-foreman works under the Foreman and has charge of several crews. He should keep in close contact with his crews to see that they are doing the job properly. He lays out work blocks under the direction of the Foreman.

Crew Leaders:

The Crew Leader is responsible for the speed, efficiency and conduct of his crews. He records the number of ribes eradicated, keeps a rough estimate of the acreage worked each day, keeps time on his men on the standard time sheet, as well as on the AP-3 form, later discussed. In addition, he does the work of a crewman.

Crewman:

The Crewman is responsible for locating and properly eradicating all ribes along his portion of the crew strip. He must cooperate with other members of the crew in order that they can function efficiently as a team. He also reports to the Crew Leader the number of ribes eradicated.

THE PULLING OF RIBES

The most important part of blister rust control work is the eradication of the individual ribes bush. Therefore a great deal of stress must be placed on the importance of doing a good thorough job of eradication.

Ribes have what we call a crown which is that portion of the bush at the junction of the stems and roots. In our shallow rooted eastern species the crown is often not so evident, especially on small bushes. However, it is there and to insure a thorough job of eradication the crown must be pulled out as well as all large roots.

The failure to remove all roots with portions of broken crown tissue attached has been one of our most serious problems. It takes quite a while for a ribes bush to grow to any considerable size from seed but a ribes sprout from an improperly pulled bush will grow back to its original size in a relatively short time. Tip sprouts caused from layered branches are another serious problem. Only too often layered branches are overlooked when a bush is pulled. Layered branches will usually sprout vigorously.

FIGURE 1 - Ribes Crown

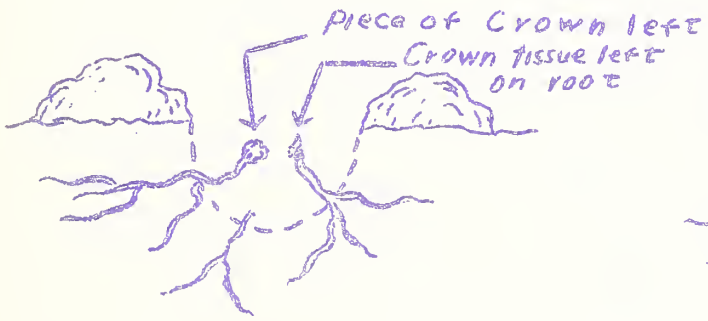


FIGURE 2 - Improperly Eradicated Bush

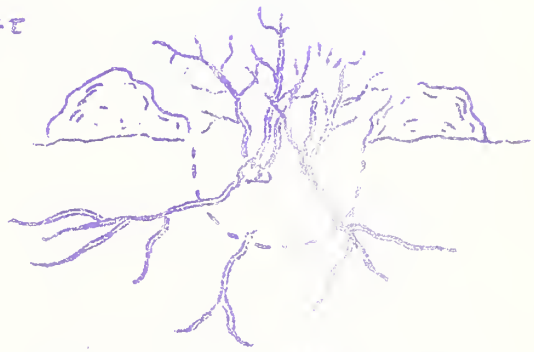


FIGURE 3 - Sprouts from broken Crowns

FIGURE 4 - Sprout from Layered Branch.

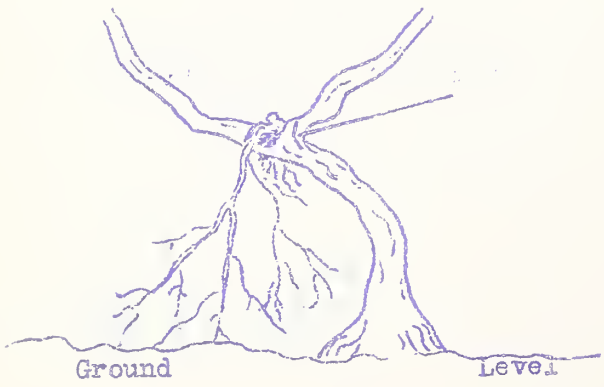
Before pulling a ribes bush the crewman should carefully look about the bush to be sure that he will not overlook small bushes growing near the larger bush. If he pulls the larger bushes first he may cover the small bushes with dirt and they will then escape his attention. He should also inspect for layered branches and remove these before he pulls up the main bush.

In pulling the bush the loose duff near the crown should be pushed aside and a firm grasp taken near the base of the bush and if possible curling the fingers under the crown. In pulling use easy short jerks, as vigorous jerking of the bushes usually results in breaking the crown and roots. After the bush is out it should be quickly inspected to see if all roots are cut and no white scars on the crown. A white scar is a sure indication that there is a root still left in the hole with crown tissue attached.

After the bush is pulled all excess dirt and litter must be shaken from the root mass before being hung up. If this is not done the bush may continue to live for several weeks even though it is off the ground. If the bush accidentaly falls to the ground there is a good chance that it will take root and continue to live and grow.

In hanging up the bushes be sure to locate a good high strong support so that the ends of the branches do not touch the ground. If this occurs tip sprouts are likely to occur. If there are no suitable trees or large brush on which to hang the bushes they may be piled on a high dirt free boulder and weighted down with stones.

FIGURE 5 - Improperly Hung Bush.



Bush hung too low. Tip ends of branches have good chance of rooting and forming new bushes. Keep Off Ground.

Occasionally bushes are found which are large and growing in heavy sod. These bushes are often very difficult to pull by hand. When such bushes are encountered a small claw pick mattock should be used to dig away the sod from around the crown. Care should be taken not to cut off the crown or large roots since much time may be lost in locating the cut roots left in the ground.

Many of our ribes areas are in rocky hollows and rocky slopes. Usually bushes growing among rocks are easy to eradicate by hand. Sometimes, however, the crowns and large roots will be growing under large rocks which cannot be moved. When these are encountered as much of crown and roots should be pulled out as possible. Three or four ounces of salt and borax poured over the exposed ends of the roots will prevent or greatly reduce the chance of sprouting.

When clumps of ribes are found growing on a slope, always pull the lower bushes first to avoid covering up or missing any of the smaller ones. (See Figure 6).

FIGURE 6 - The small ribes on lower side should be pulled first.

Each member of the crew counts the ribes as he pulls them. Small seedlings, when found, should be pulled but not counted as most of these will die anyway. Time should not be spent looking for seedlings. At the end of the strip or at any time that the Crew Leader wishes the Crewman gives his count to the Crew Leader. It is well for the Crew Leader to ask for ribes counts not more than every hour during the work day, otherwise the men may forget how many bushes they pulled. It is necessary that ribes counts are taken so that we may know where heavy concentration occurs and thus so future work plans can be made up more efficiently. At the end of the day the Crew Leader records the number of ribes pulled on the Ribes Eradication Report, Form AP-5.

The Foreman or Sub-Foreman should instruct each new man how to properly pull and dispose of bushes and how to use chemicals. Each ribes eradication crew is to carry a day's supply of salt and borax put up in individual 4 oz. paper bags.

CREW FORMATIONS

Ribes are eradicated from an area by men working in organized crews of three to five men each. Experience has shown that crew formation is one of the most important factors in securing a good ribes eradication job.

On page 7 there are several diagrams illustrating types of crew organization recommended to use in order to take care of local conditions. On open ground where ribes are light or scattered the three man crew is recommended Where ribes are fairly heavy and ground cover dense the three man crew can still be used followed by a two man "mop-up" crew. Where ribes are dense and ground cover heavy the five man crew is recommended. On very heavy patches where progress is slow advance string lines can be used for either the three man or the five man crew.

In no case should there be more than five men in a crew.

Where the crew lays its own string line the formations should be in echelon, i.e., one man following slightly to the rear and side of the man ahead of him.

The string laid by the crew should be close to the ground because it is much easier seen than if it is high in the air.

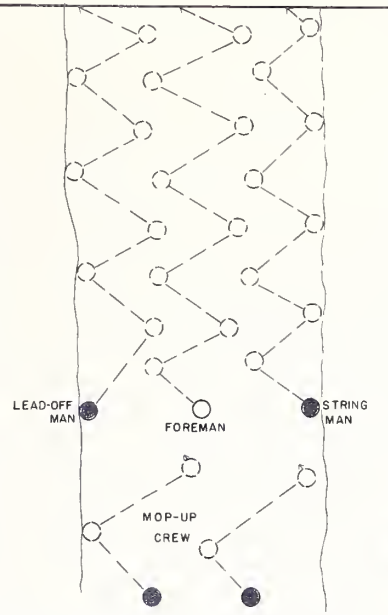
Width of Crew Strips:

In general, the width of crew strips will vary according to ground conditions, density of brush, ground cover, ribes concentrations, etc.

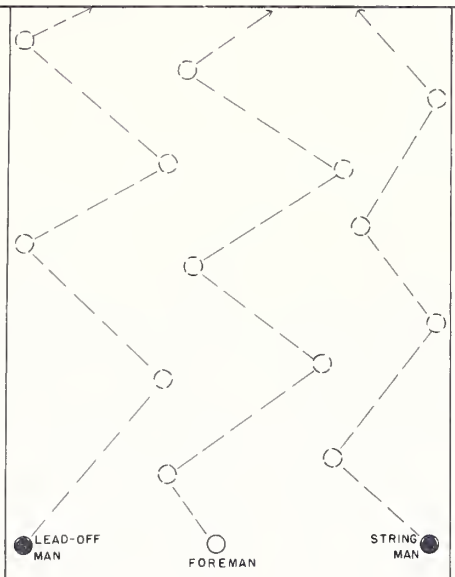
In heavy ground cover or when ribes are densely distributed the strip should not be over one chain wide. Where going is light and visibility good strips can be two to four chains wide. In all cases the crew leader should determine the width of the strip, drawing in the line when going is difficult and widening out where there is clear going. Never work the men so close together that they get in each others way nor so far apart that the strip cannot be adequately covered.

Maintaining proper crew formation is essential for efficient ribes eradication.

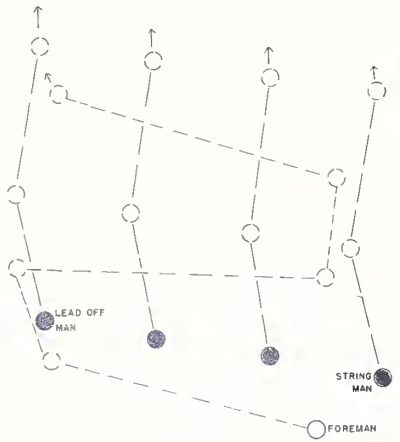
TYPES OF CREW ORGANIZATION USED ON RIBES ERADICATION



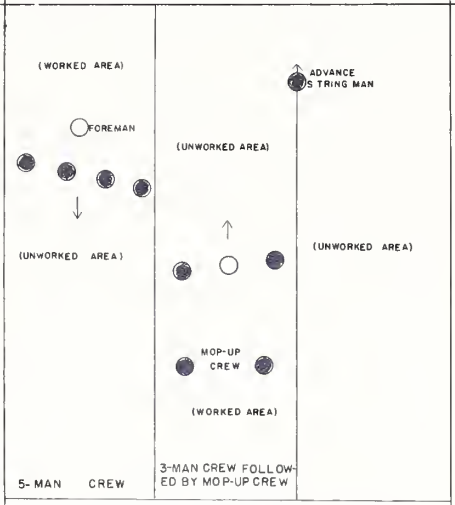
USE OF 3-MAN CREW FOLLOWD BY A 2-MAN MOP-UP CREW WHERE RIBES ARE FAIRLY HEAVY & GROUND COVER DENSE.



FORMATION OF 3-MAN CREW WHERE RIBES ARE LIGHT OR SCATTERED AND GROUND COVER OPEN (STRIP 2-4 CHAINS WIDE)



FORMATION OF 5-MAN CREW WHERE RIBES ARE HEAVY & GROUND COVER FAIRLY DENSE (STRIP 1-CHAIN WIDE)



USE OF ADVANCE STRING LINES WHERE RIBES ARE VERY HEAVY & GROUND COVER DENSE. FOR 3 OR 5 MAN CREWS. (STRIPS 40-66' WIDE.)

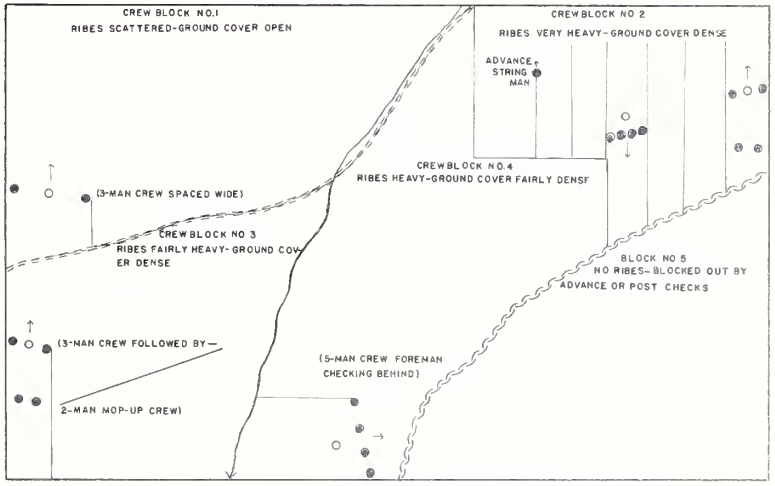


ILLUSTRATION SHOWING CREW ORGANIZATION RECOMMENDED ACCORDING TO RIBES CONCENTRATION AND GROUND COVER DENSITY.

J.C.B. 3-23-'40

CREW WORK

Organizing men into Crews:

It is imperative that crews are properly organized on the basis of their speed, efficiency, stamina and willingness to cooperate with each other. The crewmen may be good but the efficiency of the work falls directly on the shoulders of the Crew Leader. When a good Crew Leader is found and the right combination found it is not advisable to change men between crews any more than necessary.

Covering the Strip:

All the area in the strip must be examined which can only be done if the crew maintain formation. A few points to observe are:

1. In starting at a boundary line, start back of the line so that no area just within the line will be missed.

2. In crossing a creek or small hollow, the men should be extra careful in searching up and down the banks and bottom since these are places where ribes are likely to grow.

3. Ribes are often found growing in briar and blackberry patches. Do not just look around the edge of these but go through them. Checkers often report missed bushes in such patches. The ribes stick is very handy to lift and knock away brush in order to search for small ribes.

4. Ribes like to grow in moist places such as around logs, large trees and rocks, so be careful that the crewmen search around such places carefully.

5. After a crew finishes lunch the crew formation should be resumed behind the lunch area before proceeding. Ribes have often been found in the vicinity of lunch areas.

6. After a crewman helps another to clear out a concentrated patch of ribes he should return to his position of the strip where he left it so as to avoid ... bushes or part of the strip.

Direction of Strips:

The direction of crew strips will vary according to topography and ribes concentrations. If ribes are fairly well distributed over an area within a grid the strips should run either east and west or north and south. Where ribes are concentrated in rocky hollows and on rocky hillsides the strips can be run in the most advantageous manner.

On gentle slopes working along contour can be used. However, on steep rocky slopes the strips should be run up and down hill. Usually the most efficient work is accomplished when a crew works uphill. Downhill work is slightly less efficient than uphill work because searching is more difficult as the men must look behind them for ribes that may be hidden by brush when viewed from above.

Speed of work:

In areas supporting numerous ribes the men should concentrate on pulling bushes and keep searching time down to the minimum. Where such a condition exists a mop-up or rework crew can follow later searching for missed bushes.

Where ribes are medium to light crew work should progress as rapidly as possible and still meet the desired live stem standard in one working. Rework prior to checking on such areas should be avoided since it takes time and costs money to cover an area even if no ribes are pulled.

String Lines:

String has been found to be the best means in lining our crew strips. It is easy to follow in the woods and will usually stay put for several days. It also makes it easier for the checker to locate the crew blocks after the eradication job is completed.

When laying string lines it is advisable to insert a short stick twelve to sixteen inches long tightly into the hollow center of the string ball. The ball is carried on the stick and is allowed to unwind as the worker moves ahead. When crossing deep ravines the string should be tied down. The man handling the string should not spend his time concentrating on the string line since this job is incidental to searching for and pulling ribes. (Figure 7).

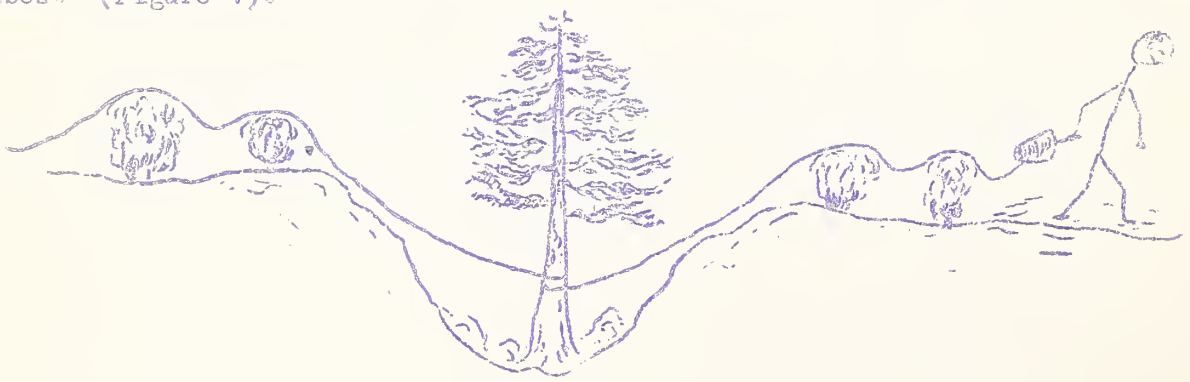


FIGURE 7 - Laying String Lines

When roadsides are approached never carry the string across but tie it at least 10 to 15 feet from the edge of the road. This also holds for trails except that the string need only be tied at the edge of the trail. When crossing the Southern Appalachian trail, bridal paths and paths in recreation areas the string should always be tied far enough back so that the string will not be noticed by the public.

When roads and trails can be used as one side of the crew strip do not put string on that side since it is already marked by the edge of the road.

When reaching a crew block boundary string do not tie the strip string to the boundary string but carry it about 10 feet beyond the boundary string and secure it to brush, trees, etc.

Never leave string balls in the woods over night.

Causes of Poor Crew Work:

There are several causes of poor crew work which can be attributed to the following practices:

1. Careless pulling of ribes resulting in the leaving of large broken roots, crowns, and stems.

2. Careless disposing of ribes such as not hanging securely or allowing branches to touch the ground.

3. Failure to cover the entire strip.

4. Crew too large causing crowding of men in strip.

5. Poorly organized crew.

Ribes Sites:

Although ribes can be expected to be found almost anywhere we do recognize certain sites which are more favorable than others. As we go south from Maryland to Georgia ribes sites are more definitely defined. In general, the more favorable sites are as follows:

1. Moist rocky hollows.

2. Rocky or shaley slopes.

3. Around rotton logs or stumps.

4. Rock piles in old pasture fields.

5. Under down timber and on roots of windfalls.

6. Near base of large trees.

7. Around springs, seepages, depressions and creeks.

8. Along ridge tops at high elevations.

9. Around disturbed areas such as new roads, logging roads, trails, etc.

10. Often found growing in greenbrier and wild blackberry patches.

GENERAL WORK AND SAFETY PRACTICES

Safety practices must be stressed among workers working on ribes eradication crews in the field.

1. Each worker should carry a stout stick about 5 feet long. This stick is not only handy for assisting in the search of ribes hidden under brush around low growing hardwood reproduction but is also handy for disposing of poisonous snakes.

2. If a mattock is carried by the crew it should never be carried over the shoulder as it may cause head or neck injury if the man falls. Never throw tools of any kind.

3. When following another man through the woods stay far enough behind to avoid being struck by branches that swing back from his passage.

4. Walk carefully over logs while crossing streams.

5. Gloves should be worn when pulling ribes to avoid serious injury to hands from thorns, rocks, etc.

6. Keep crewmen together especially when traveling to and from the strips. All men should use the same route going to and from the truck. A lost crew is much easier to find than a lost man.

7. See that men are wearing good heavy shoes or boots. Composition or cord soles will prevent a good deal of slipping on wet leaves or rocks. Hobnails or calks are dangerous on rocks.

8. On steep rocky slopes the men are to work abreast and only up or down hill. This removes the danger of being hit with a rolling rock.

9. If ropes are to be used for removing ribes from cliffs be sure that it is understood what type of rope to use and the proper hitch. Cliff work should be avoided if possible.

10. Each crew leader is to carry a first aid and snake bite kit. All injuries, no matter how slight, are to be reported immediately.

11. Do not mess up the woods with lunch papers or other trash. Food scraps should be scattered and paper buried.

12. Avoid drinking out of streams which may be polluted. Use springs or carry individual canteens.

13. Do not drink too much water in hot weather. Use salt tablets to avoid the possibility of heat strokes. Take one tablet followed by a full glass of water.

14. Do not molest wild life. Bears can be dangerous if their cubs are molested. A doe will often abandon her faun if touched by human hands.

No smoking is to be done while the men are walking through the woods. Smoking periods should be given and all duff and trash is to be cleared down to mineral soil. Be sure every spark is out before going on. Extreme care is to be taken during the spring and fall fire seasons. There will be no excuse for any of our men being responsible for causing the start of a forest fire.

TRAINING

Although we have many men who have had many years of experience on ribes eradication we do employ many new men each season. It is the duty of the Field Supervisor to see that these new men are properly trained and certain faults corrected in the case of older employees.

A few things the new man should know are:

1. Regulations governing his conduct and welfare while employed by the Government.

2. Hours of work and rates of pay.

3. Brief description of the blister rust organization.

4. A brief description of the rust and where it is to be found.

5. The value of white pine.

If there are only a few new men to be trained they can be assigned to regular experienced crews. If, however, entire new crews are to be trained they should be trained as organized crews on an area selected which is typical of average ribes eradication conditions.

In training the men it is essential that they get started off right. First of all they should know how to pull a bush correctly and how to dispose of it properly. They should know how to cover the strip and where to look for ribes. They should know how to lay string lines.

For general information on blister rust refer to Part I of this manual.

PLANING THE SEASON'S WORK

In any one Field Supervisor's work area the work should be so planned that the eradication job progresses in an orderly manner. The grid is the work unit and each grid should be completed before starting on another. Skipping about should be avoided. By keeping the work consolidated makes it easier for supervision and checking.

Within the grid crew block boundaries are to be laid off with string placed about six feet above the ground so as to keep animals from breaking them. If available, red and white string should be used for marking boundaries. Block boundaries should be laid out according to the ribes distribution covering more territory than they need to cover. The blocks should have a fairly uniform distribution of ribes occurrence. Make the blocks as regular in shape as possible in order to avoid triangular areas when the work nears completion. Make the blocks large enough so as to avoid moving crews too often.

The crew organization used should depend on ribes concentration and ground cover density. Do not use more than five men (including the Crew Leader) in any one crew. (See illustration on page 7.

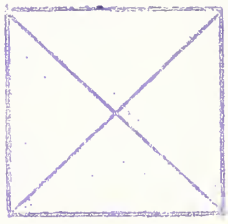
MAPS AND RECORDS

In order to measure production and to facilitate future ribes eradication programs it is necessary for the Field Supervisors to prepare certain maps and to record ribes eradication data on forms provided for that purpose.

Current Progress Map: This is a work map which may be a regular county index map or a larger scale map made up from a Forest Service District map or any other available source. No special symbols have been used for showing progress on these maps, this being left more or less to the discretion of the Field Supervisor. It is suggested, however, that blocked out ribes-free areas be colored with a yellow crayon, progress of crew work with a green crayon and grids completed and passed by the checker overlayed with an "X".

Block-Out

Crew Work



Crew Work Completed in Current Season

FIGURE 8 - Symbols recommended to use on Current Progress Map.

Final Eradication Map:

The final eradication map will be shown on the 4" to the mile map on revised Form AP-2. On this map the checkers strips will show the crew block boundary. All portions being ribes-free will be marked as blocked out using the symbol (B.O.). See page 15 for final eradication map as indicated by the checker.

Reports and Records:

Daily crew reports are usually kept by the Crew Leader in an ordinary note book on which he records the number of ribes pulled. At the end of the day he summarizes his data and enters it on revised Form AP-3, "Daily Eradication Report". A separate AP-3 Form is to be used for each new grid worked in. On the form the Crew Leader records the date, number of men in party, acres worked, number of ribes pulled and total hours worked.

The total hours recorded for the Crew Leader and his men on any particular day must agree with the hours shown on the time sheet. A sample AP-3 Form for ribes eradication is shown on page 16.

When work is completed on any work block during the reporting period shown on the AP-3 Form the Supervisor should show the adjusted acreage worked below the estimated acres worked by a circled figure.

AP-2
(REV.12-17-45)

RIBES ERADICATION AND REGULAR CHECKING REPORT

STATE: Virginia OWNERSHIP: Fed & Priv. BLOCK NO.: 10
COUNTY: Augusta FOR. OR PARK: G.W.N.F. GRID NO.: 11-10
QUADRANGLE: NAME OF AREA: North River AREA NO.:
OPERATING AGENCY: Bureau DATE ERADICATED: July (MONTH) 1945 (YEAR)

CONTROL RECORD

OWNERSHIP	WORKING (1ST. 2ND. 3RD., ETC.)	ACRES WORKED			MAN-DAYS	RIBES PULLED			PER ACRE		
		CREW	B.O.	TOTAL		WILD	CULT.	TOTAL	MAN-DAYS	RIBES	COST
Federal	2nd.	—	320	320	31	6491	15	6506	0.5	105	$2.35
Private	1st.	62	258	320							
					RE WORK 1						
					RE WORK 2						
TOTAL		62	578	640	RE WORK 3						
			TOTAL →		31	6491	15	6506			

STATUS OF CONTROL

OWNERSHIP	CONTROL ACRES	ACRES WHITE PINE			ACRES ON MAINTENANCE			YEAR PREV. WORK
		NATIVE	PLANTED	TOTAL	RIBES-FREE	OTHER	TOTAL	
Federal	320	176		176	320		320	1939
Private	320	184		184	258		258	
TOTAL	640	360		360	578		578	

CHECKING DATA

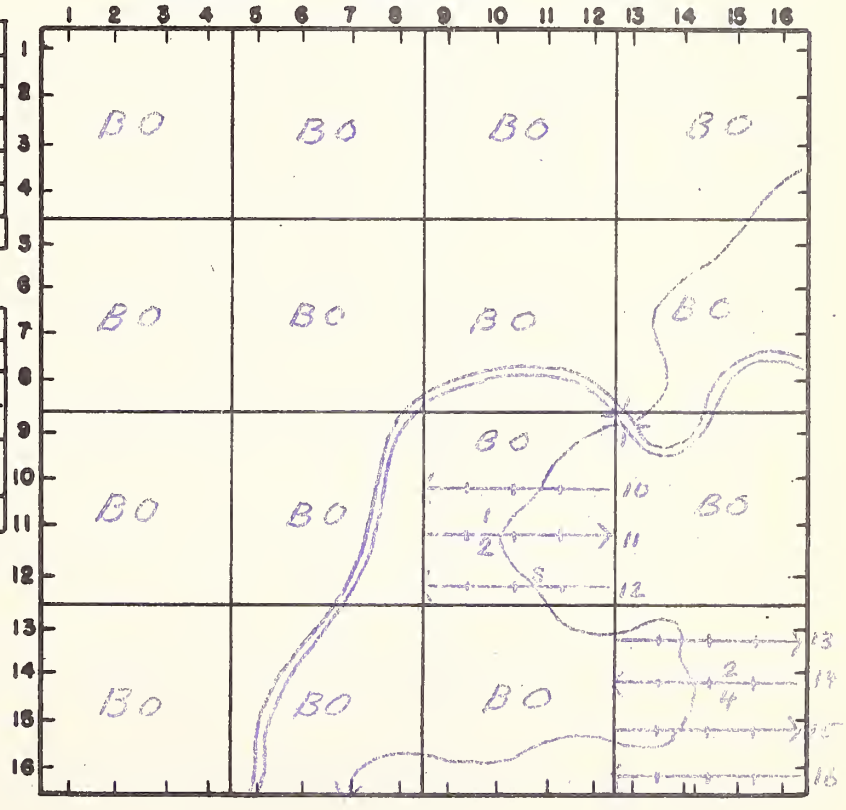
STRIP DATA	1	2	3	
STRIP ACRES	3.5			
ACRES COVERED	70			
TOTAL RIBES	4			
TOTAL F.L.S.	6			
RIBES PER ACRE	1.1			
F.L.S. PER ACRE	1.7			

CHECKING NOTES

SEEDLINGS	✓			
MISSED BUSHES				
SPROUTS	✓			
CROWNS LEFT				
BUSHES HUNG PROPERLY	✓			
DATES CHECKED	7/17			

John Dale - Checker

REGULAR CHECKING MAP



AP-3 PART IV
(REV. 12-17-45)

DAILY ERADICATION REPORT

Sheet 1

STATE: Virginia COUNTY: Augusta FOREST: G W YEAR: 1945
BLOCK NO. 10 GRID NO. H-10 LOCATION South River
OPERATING AGENCY: Bureau REPORTING PERIOD: 7/1-14/45

DATE	RIBES ERADICATION						OTHER ACTIVITIES		TOTA HOURS WORKED
	NO. MEN IN PARTY	ACRES WORKED	RIBE PULLED			HOURS WORKED	HOURS WORKED	DETAIL	
			WILD	CULT.	TOTAL				
4	5	8	1500		1500	40			40
5	5	7	1864	15	1879	40			40
6	5	12	823		823	40			40
9	4	10	798		798	32			32
10	5	4	465		465	36	4	S.L.-J.C. Davis	40
11	3	6	498		498	24	8 8	S.L.-J.C. Davis A.L.-R.L. Jones	40
12	5	11	543		543	20			20
Completed work on grid H-10 at noon on July 12. Started on grid H-11 (See Sheet 2)									
TOTAL Adj→		58 62	6491	15	6506	232	20		252

AP-3
(REV. 1½-17-46)

DAILY ANALYSIS SHEET FOR MAPPERS AND CHECKERS

(RIBES ERADICATION ON REVERSE SIDE)

STATE: _____ COUNTY: _____ OPERATING AGENCY: _____

TIME KEEPER: _____ REPORTING PERIOD: _____ YEAR: _____

DATE	NO. OF MEN IN PARTY	SURVEY				CHECKING						OTHER ACTIVITIES		TOTAL HOURS WORKED
		CONTROL		MAPPING		ADVANCE		POST		REGULAR				
		HOURS WORKED	CHAINS RUN	HOURS WORKED	STRIP ACRES	HOURS WORKED	STRIP ACRES	HOURS WORKED	STRIP ACRES	HOURS WORKED	STRIP ACRES	HOURS WORKED	DETAIL	
TOTAL														

LIST OF REFERENCES USED IN PREPARING MANUAL

1. "Ribes Eradication and Checking Manual for Blister Rust Control in the Pacific Coast Region" - 1945

2. "A Manual of Compass and Tape Surveying For Use in Blister Rust Control Work". By John N. Mitchell, Forester, Oakland, California - 1941.

3. "Aids to Checkers" - Pacific Coast Region, Oakland, California, 1943.

4. "Compass Surveys" - U. S. Coast and Geodetic Survey, Department of Commerce Serial No. 289.

5. "A Taxonomic Review of Currants and Gooseberries" - Alvin Berger, New York State Agricultural Experiment Station, Geneva, N.Y. - Technical Bulletin No. 109, December, 1924.